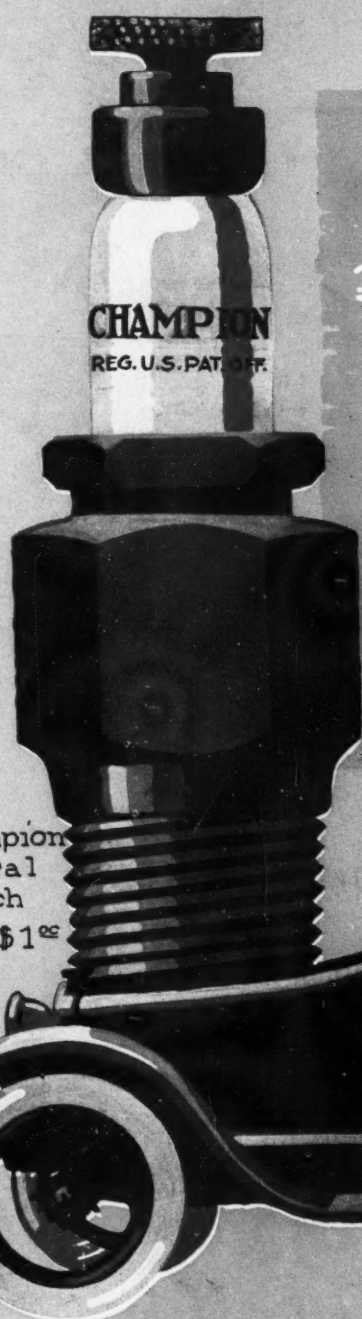


MOTOR AGE

Vol. XXIX
No. 26

CHICAGO, JUNE 29, 1916

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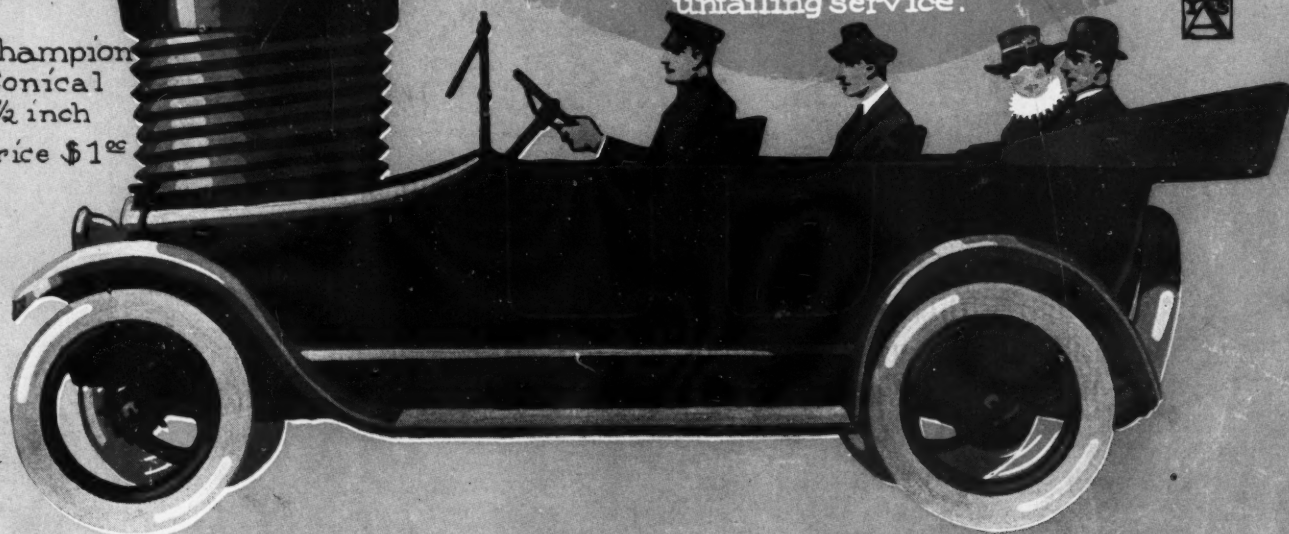
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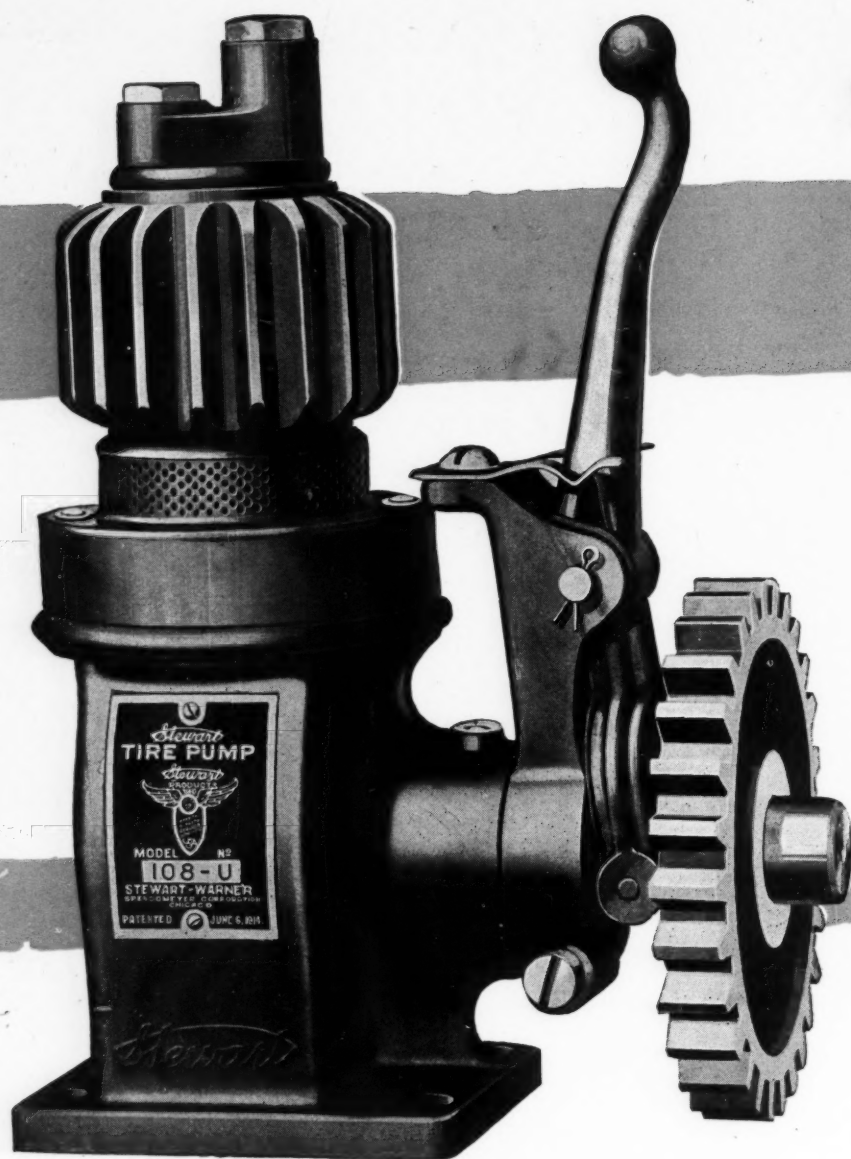
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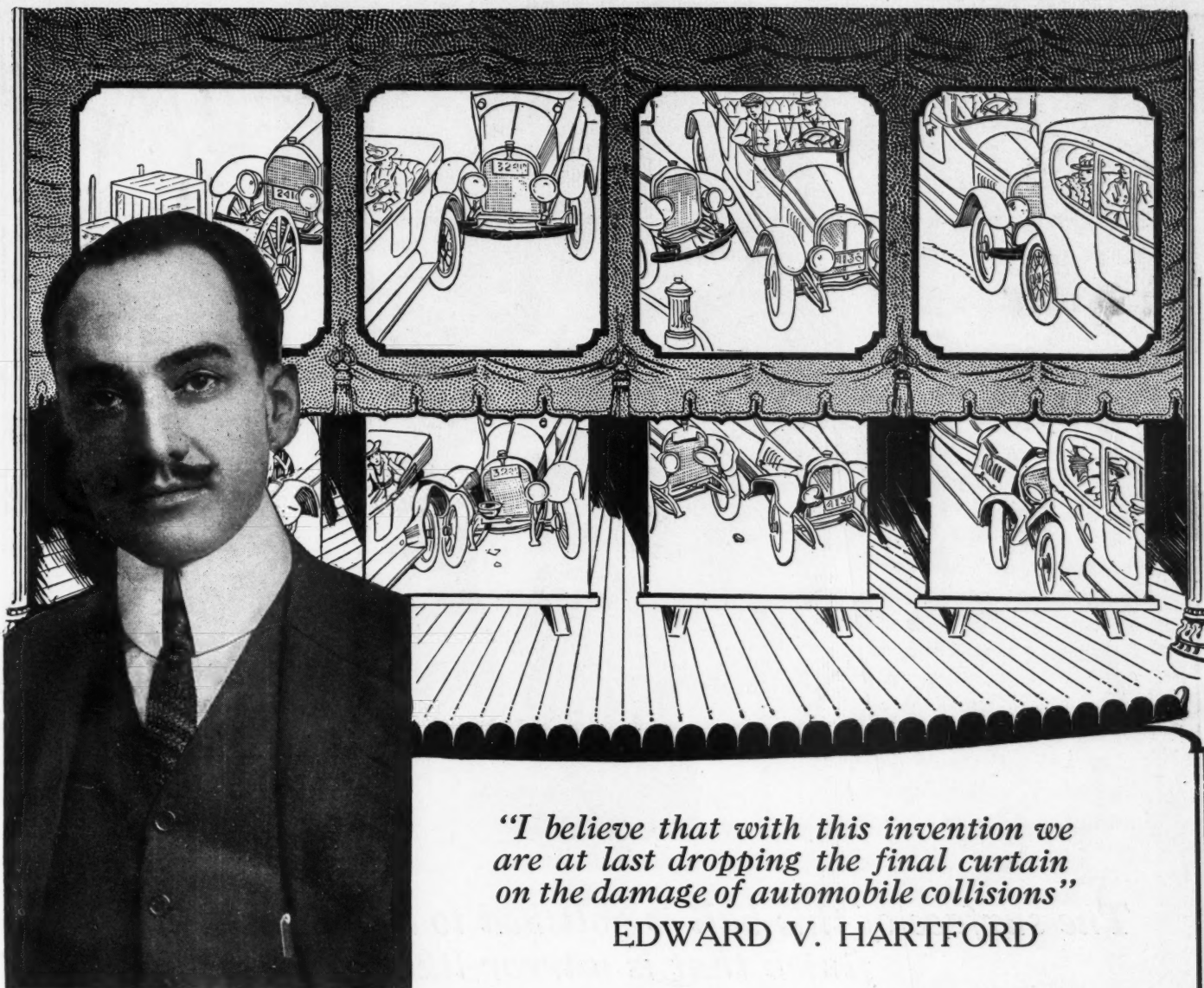
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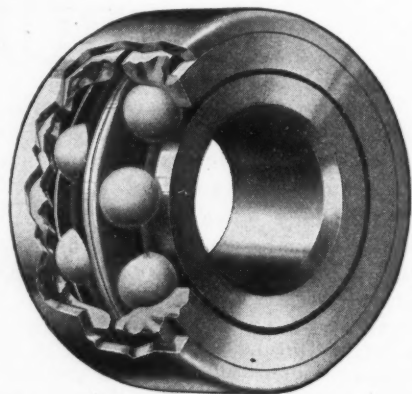
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MOTOR AGE

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ANNOUNCEMENTS

Independence Day Races, which will be the feature of the issue of Motor Age for July 6, will offer full reports of the speed events on the tracks at Twin Cities, Sioux City and Tacoma.

READ

The First Installment of

The Electrical Equipment of the Motor Car

Starting in This Issue

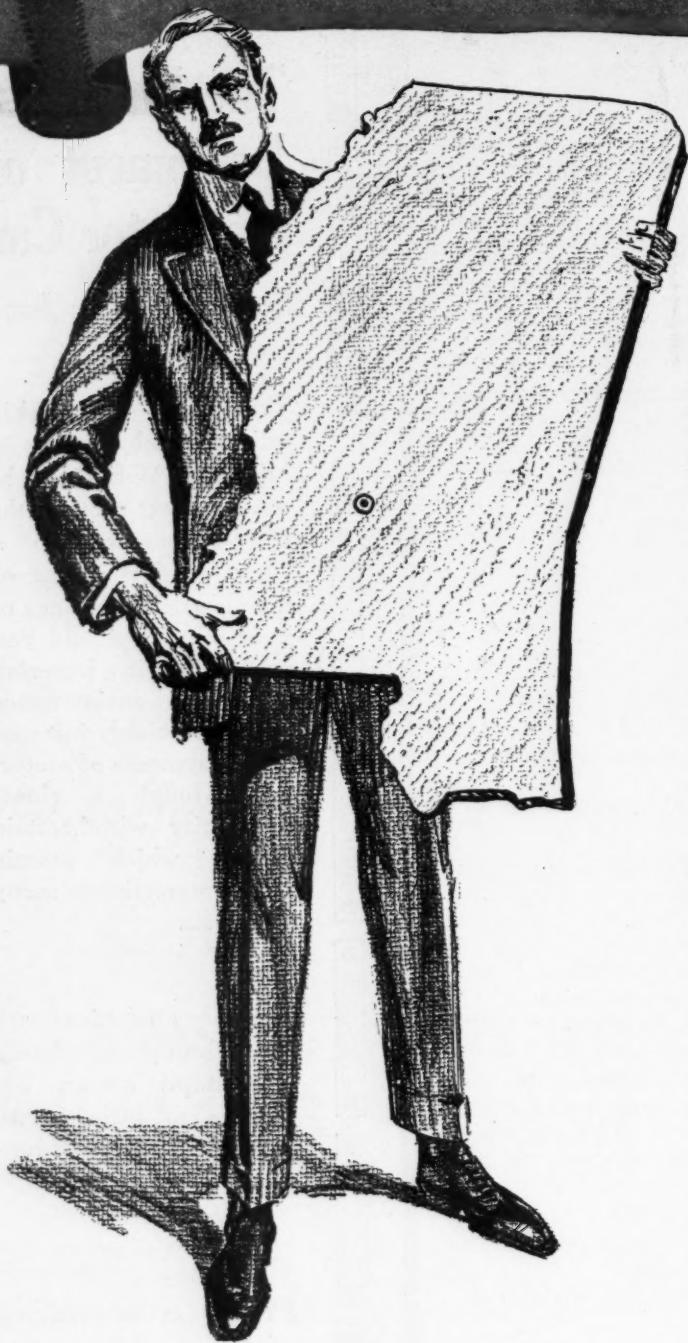
This series of weekly articles which appears in MOTOR AGE throughout the next six months will assist you to a clearer understanding of the electrical workings of your motor car, aid you materially in lowering cost for maintenance and appreciably increase the enjoyments of motor-ing through a closer familiarity with certain phases which remain veiled mysteries to many motorists.

Simple analogies are used throughout—easily understood even by readers of little or no technical learning whatever.

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MOTOR AGE

Electrical Equipment of the Motor Car

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Think Electrically

EDITOR'S NOTE—Herewith is presented the first installment of a series of articles designed to give the motorist the knowledge necessary to enable him to care for and repair any and all of the electrical features of his car, no matter what make or model it may be. The information it is planned to offer in this series will be equally valuable to the repairman, whether he be skilled in things electrical or have a very limited acquaintance with them. For the sake of the majority of readers, whose real knowledge of electricity is more general than definite, it has been thought wise to begin with the very first principles of electrical phenomena, in order that they may be able to follow the circuits on the electrical systems of their cars with the certainty that they are right. To the lay reader, the first few installments of this series are the most important, for without them, wiring diagrams, trouble charts and repairing instructions are useless; with the groundwork well laid by study of the early portion of the series, the reader will be able to THINK ELECTRICALLY, and a tangle of wire under a car or a tangle of lines on a wiring diagram will become clear.



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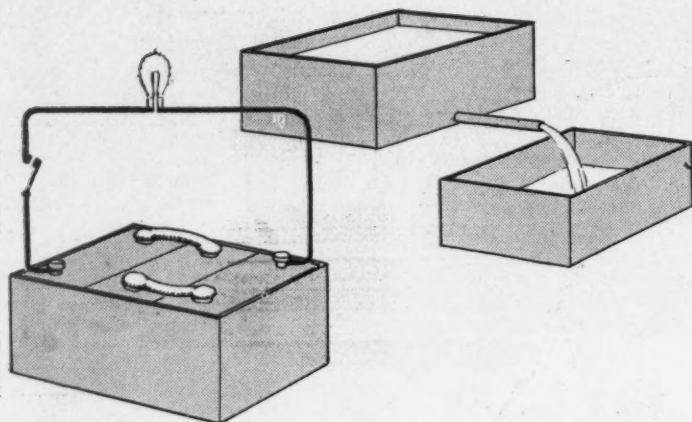
The first element in the thorough understanding of electrical apparatus is the idea of the circuit. At the conclusion of this series, "Electrical Equipment of the Motor Car," with additions, will be published in book form by the Class Journal Co., Chicago, in a size to fit the pocket conveniently.

Part I—Fundamentals of Electrical Circuits

ELECTRICITY in its many applications, as found on the modern motor car, plays no small part in the successful and satisfactory operation of the motor car as a unit and the degree of comfort and luxury it is possible for the manufacturer to provide.

It is responsible for the spark that ignites the mixture of gas and air in the cylinder and makes the engine operate; it lights the car, starts the engine, and operates the horn. There are cars in which it heats the fuel; others in which it shifts the gears and in some still newer designs, even replaces clutch and gearset in the transmission of the power of the engine to the rear wheels.

The exact nature of electricity is not known and no attempt will be made to give any explanation as to what it may be. You can, for convenience, think of electricity as being the name given to that something which produces certain results which we call electrical, such as lighting, the arc formed when a trolley wheel breaks contact with the trolley wire, the sparks formed in stroking the cat's back, etc. We are all familiar with the fact that if we step out of a window without any means of support, we are sure to fall to the ground or sidewalk. The reason of our falling is due to the attraction of the earth on our bodies, which is called gravity. The



Figs. 1 and 2—Electrical and water circuits contrasted. The electrical circuit at the left must be complete before there will be a current of electricity, but the water system, at right, need not be a complete circuit for a current of water to flow in it

exact nature of this attraction is not known any more than the exact nature of electricity is known. The action of gravity under certain definite conditions, however, is well known, and so is the action of electricity under certain definite conditions quite well known.

Since we know the action of electricity under definite conditions, it is possible to make practical use of it in operating the lamps, starting, motor, etc., on the motor car, even though its exact nature is not known. For the sake of convenience in dealing with electricity, we can think of it as a fluid such as water, but it must be remembered at all times that this similarity has to do with the action only and does not necessarily mean that the two are identical.

The Electrical Circuit

The electrical circuit is the fundamental basis of the many applications of electricity to the motor car, and, in order to understand thoroughly the principles, operation and maintenance of these applications, it is essential that we have a quite complete knowledge of the electrical circuit and its more common properties and characteristics.

The electrical circuit is the path in which the electricity flows, just as the water pipe is the path in which the water flows or a river bed is the path in which a river flows.

There is one great difference, however, between the electrical circuit and the ordinary circuit in which the water flows, and that is that the electrical circuit is always closed on itself while the water circuit is not necessarily always closed.

This difference may be illustrated by two different examples as follows: Suppose we take a small lamp and connect it to a storage battery by means of wires and a switch, as shown in Fig. 1. There will be no flow of electricity through the lamp unless the switch is closed, or, as we say in practice, unless the circuit is complete. In the case of the flow of water in a pipe, the pipe may be conducting the water from one tank to another as shown in Fig. 2 and it is not necessary to have a pipe from the second or lower tank back to the first or higher tank in order that there be a flow of water in the pipe.

The fact that the electrical circuit must be complete and cannot merely conduct electricity from one point to the other, as the pipe conducts water from one tank to the other, Fig. 2, is the keynote of the electrical circuit. Referring to Fig. 1—the complete electrical circuit is made up of many parts, wires, lamps, switch, battery terminals, battery plates, electrolite, etc., all combined in a continuous path, circle or circuit, as you choose to call it.

We can think of the electrical circuit just as we think of the circle; that is, it is continuous and has neither beginning nor end. If we started at any point on the electrical circuit and follow along the circuit we will arrive at the point from which we started just as we return to the starting point in following along a circle, regardless of the point from which we started.

In order to emphasize the importance of the reader getting this circuit or circle idea thoroughly in mind, the various circuits of the modern motor car are indicated in their circular form in Fig. 3.

These circuits and their relations to each other will be taken up in detail later. It is not humanly possible to make changes or locate troubles in the electrical equipment of a car unless this circuit idea is followed, either consciously or unconsciously.

The circle or circuit is to electricity what the metal rails are to the railroad train. Your train cannot run without the track, as electricity cannot be made use of except in a circuit.

Let us draw a circuit parallel from nature: If we follow a drop of water along one of Nature's circuits, as shown in Fig. 4, the water falls as rain upon the ground, runs into the little brooks, creeks, larger rivers and then into the ocean, where it is in turn evaporated by the sun, then carried over the land in the form of clouds by the wind, and again falls as rain. The path of the water in this great natural circuit—which we will call Nature's circuit—corresponds in a great measure to the electrical circuit inasmuch as it is a circle, a system without start or finish, beginning or end.

It is evident that in Nature's water circuit there may be an accumulation or decrease in the quantity of water at any point in the circuit. That is, the amount of water evaporated by the sun in a given time is not necessarily equal to the quantity falling as rain in the same time. Nor is the amount flowing into the ocean from the rivers in a given time necessarily equal to the amount running into the rivers from their various tributaries and along their banks in the same time.

In an electrical circuit similar to Fig. 1, the quantity of electricity leaving the lamp is exactly equal to the quantity of electricity entering the lamp and the same quantity of electricity returns to the battery as leaves it. There is no accumulation of electricity at any point along the electrical circuit similar to the accumulation of water at different points along Nature's water circuit.

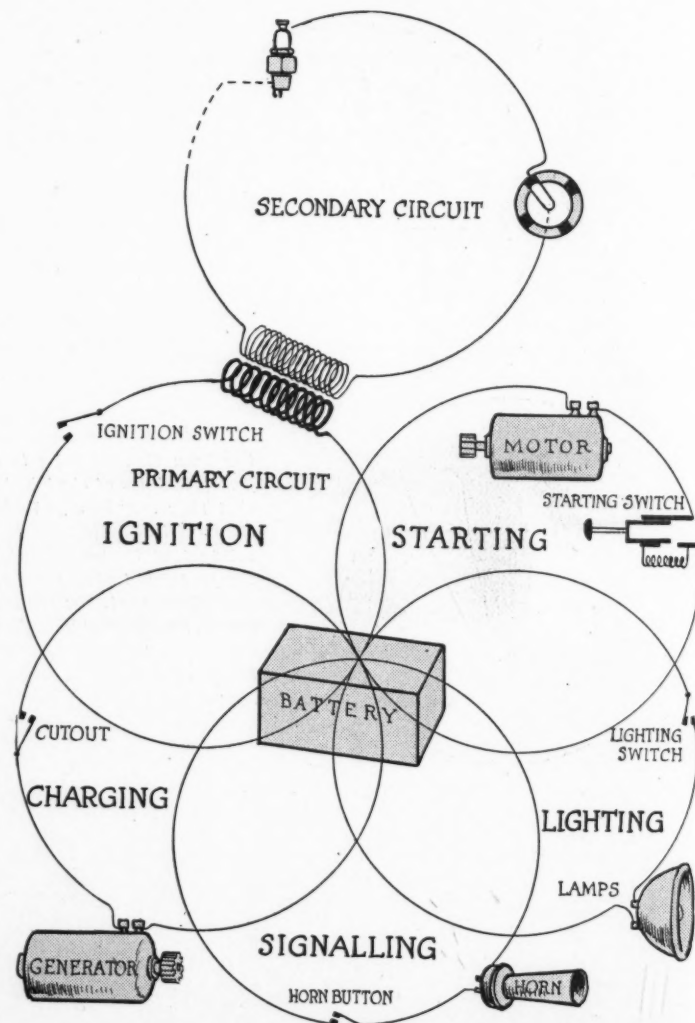


Fig. 3—The major circuits in the motor car. Starting, lighting, ignition, signalling and all electrical features of the car are operated in complete circuits which are indicated here as circles



Fig. 4—Nature's great water circuit, typical of the electric circuit. A drop of water falls as rain upon the ground, runs finally into a river and thence into the ocean, where it is evaporated by the sun and carried back in the form of clouds over the land and again falls as rain to repeat its travels again and again

The operation of a water circuit similar to the one shown in Fig. 5 corresponds more nearly to the operation of the simple electrical circuit than Nature's water circuit. The water circuit shown in Figure 5 consists of a pump P connected to a curved piece of pipe. When the pipe and pump are filled with water the flow of the water in the pipe, due to the action of the pump, will be very similar to the flow of the electricity in the simple electrical circuit shown in Fig. 6, which consists of a piece of wire connected to the terminal of a storage battery. Both of these circuits are complete; they are closed on themselves and, like the circumference of a circle, have neither beginning nor end.

The quantity of water entering one end of the pipe from the pump is exactly equal to the quantity of water leaving the other end of the pipe and entering the pump. Likewise the quantity of electricity entering one end of the wire from the battery is exactly equal to the quantity of electricity leaving the other end of the wire and entering the battery. The pump does not produce the water but merely causes the water to flow through the pipe. The battery does not create electricity, but merely causes the electricity to flow through the wire.

Electrical Current

It is obvious that the action of the pump in the water circuit and the action of the battery in the electrical circuit are very similar. There is a mechanical pressure produced by the pump which causes the water to flow through the pipe, and the battery produces what is called an electrical pressure which causes the electricity to flow through the wire.

If the mechanical pressure produced by the pump be increased or decreased, there will be a change in the flow of the water in the pipe, the flow increasing with an increase in pressure and decreasing with a decrease in pressure. This flow, or movement of the water in the pipe, may be measured by determining the number of gallons passing a certain point in the pipe in, say, 1 second. You could then speak of the flow of water in the pipe as being so many gallons per second. Any unit of quantity and time may be used in expressing the flow of water in a pipe, such as so many cubic feet per minute, so many gallons per hour, etc.

The flow or movement of electricity in the electrical circuit is measured in a similar manner to the flow of water in a pipe; that is, by determining the quantity of electricity passing a certain point in the electrical circuit in a certain time. Instead of measuring the quantity of electricity in gallons or cubic feet, as in the measurement of water, it is measured in a unit called the coulomb.

In referring to a certain quantity of electricity it is spoken of as so many coulombs just as a certain quantity of water is spoken of as so many gallons, so many cubic feet, etc.

The Ampere

If the water in a pipe, such as the one shown in Fig. 5, is moving at such a rate that there is 1 gallon of water passing every point along the pipe each second, there is said to be a flow of 1 gallon per second in the pipe. Similarly, if the electricity in a circuit, such as the one in Fig. 6, is moving at such a rate that there is 1 coulomb passing every point in the circuit in each second of time, there is said to be a flow of 1 coulomb per second. The flow, or movement of the water in the pipe, is called the current of water, just as the flow of the water in a river is called the current, and, likewise, the flow of the electricity in the electrical circuit is called the current of electricity or more commonly the electrical current. From the above discussion, it is seen that the current of water is expressed as so many gallons per second, so many cubic feet per minute, etc., while the current of electricity is expressed as so many coulombs per second.

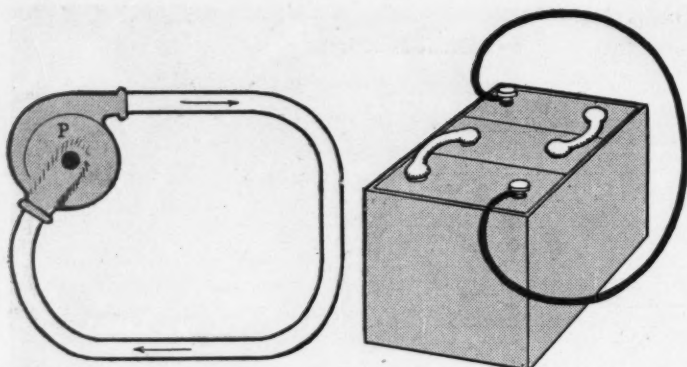
Fortunately we have a special name for this rate of flow of electricity of one coulomb per second, which is called the ampere. This way of giving the rate of flow a special name relieves us of the necessity of saying "per second" each time, as would be the case if we were to speak of the current as so many coulombs per second. Thus a current or rate of flow of 10 coulombs per second is just 10 amperes; 50 coulombs per second is 50 amperes, etc. In the majority of cases we are not interested in the quantity of electricity alone, but in the rate of flow, the ampere, and for this reason the coulomb is very little used.

Unfortunately there is no name for the rate of flow of water, and we always have to use some such cumbersome expression as gallons per second, cubic feet per minute, etc.

Electrical Pressure

The number of gallons per second of water flowing through a pipe depends in a large measure upon the pressure causing it to flow. This pressure in the water circuit is measured as so many pounds per square inch or so many pounds per square foot. In a similar manner, the current of electricity, in amperes, in a wire depends in part upon the pressure under which the electricity flows.

The electrical pressure is measured in a unit called the volt. The volt means exactly the same thing in speaking of an electrical circuit as the pound pressure does in speaking of the water circuit.



Figs. 5 and 6—Simple water and electrical circuits. The battery may be likened to the pump and the wire to the water pipe. Both of these circuits are complete

A higher pressure will be required to force the same current of water through a small than through a large pipe, and a higher electrical pressure will be required to force the same current of electricity through a small wire than through a large one. Similarly higher pressures will be required in both the water and electrical circuits if the length of the circuits be increased; that is, if the length of the pipe and wire be increased.

The pressure produced by the pump might be called the water moving force, while the pressure produced by the battery may be called the electricity moving force or electromotive force. The electromotive force is usually represented by the abbreviation e.m.f.

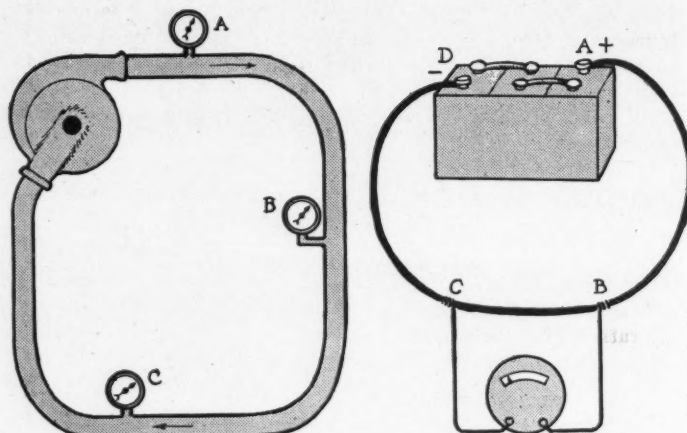
If pressure gauges be connected at various points along the water pipe, Fig. 7, they will indicate the pressure at the different points. There will be a difference in the pressure as indicated by the various gauges, if there is a current in the pipe, and their indications will be less and less as you pass along the pipe in the direction in which the water is flowing. The difference in the value of the pressure as indicated by any two of the gauges connected to the pipe will represent the pressure acting on the portion of the pipe between the two points where the gauges are attached. This difference in pressure between two points on a pipe is called the drop in pressure or merely the drop between the two points. The pressure between two points along a stream of water is often spoken of as the difference in level, the drop in level or merely the drop between two points.

Voltage Is Difference in Pressure

In the case of the electrical circuit, there is a difference in the electrical pressure between two different points along the circuit. This difference in pressure between any two points is measured in volts just as the total pressure produced by the battery is measured in volts. The pressure at any point in an electrical circuit cannot be measured by attaching a suitable instrument to the circuit at that point alone, similar to the attachment of the pressure gauge to the water pipe, but the instrument must be attached to two points as shown in Fig. 8, and then it does not read the pressure at any particular point but the difference in the pressure between the two points on the circuit where it is connected. This difference in pressure, or voltage, as it is usually called, between any two points along a circuit is sometimes spoken of as the drop between the two points.

The water in the pipe flows from a point of higher pressure toward a point of lower pressure. The electricity in the electrical circuit flows from the point of higher electrical pressure or higher electrical level toward the point of lower electrical pressure or electrical level. In the electrical circuit the point of higher pressure is usually marked with the plus sign (+) and the one of lower pressure with the minus sign (—). The terminal of the battery from which the electricity flows when the battery is discharging, is called the positive terminal, while the terminal toward which the electricity flows is called the negative terminal.

Any point along the wire will be positive with respect to points further along the wire in the direction of the current, and negative with respect to points along the wire opposite the direction of the current, just as the pressure indicated by any gauge is higher than the pressure indicated by gauges connected to the pipe at points further along the pipe in the direction of the water current and



Figs. 7 and 8—The pressure in an electrical circuit, at the right, changes along the wire just as the pressure in the water circuit, at the left, decreases along the pipe—How the difference in pressure is measured

lower than the pressure indicated by gauges connected to points on the pipe opposite the direction of the water current.

To explain: In Fig. 8 point A is at a higher electrical pressure than B, likewise B is at a higher electrical pressure than C, so that B is positive with relation to C, but negative with relation to A.

The reader should have clearly in mind by this time the distinction between amperes and volts. The amperes represent the value of the current in the circuit—that is, the number of coulombs of electricity that pass through the circuit during one second, while the volts represent the pressure causing this current or movement of electricity.

Resistance to the Flow of Electricity

It is possible in both the water and electrical circuit to have a pressure acting in the circuit when there is no current. It is perfectly plain that if the path of the water be blocked or interrupted by closing a valve in the pipe, Fig. 9, there will be no current of water, although there may be a high pressure produced by the pump. If the path in which the electricity moves is blocked or interrupted by opening a switch or cutting the wire, there will be no current in the circuit, although the pressure may be high.

The currents of water and electricity are, therefore, dependent upon something besides the pressure. This something which opposes the flow of water in the water circuit and the electricity in the electrical circuit is called the resistance of the circuit. The resistance of an electrical circuit simply opposes the free flow of electricity through the circuit; yet the resistance does in no way tend to cause the electricity to flow in the direction opposite to that in which it is flowing. If you push against the wall of a building, the wall opposes the action of your force, yet the wall will not push you backwards when you stop shoving.

The greater the resistance of an electrical circuit the less the current a certain pressure will produce and the smaller the resistance of the circuit the greater the current a certain pressure will produce.

There is no unit in which the resistance offered by a pipe may be measured. The resistance of an electrical circuit is measured in a unit called the ohm. A circuit is said to have a resistance of 1 ohm where an electrical pressure of 1 volt will produce a current in the circuit of 1 ampere.

Electrical and Water Circuits

The following table gives in condensed form the names of the units in which the common qualities associated with the electrical and water circuits are measured:

	WATER	ELECTRICITY
Quantity	Gallon, cubic foot, etc.	Coulomb
Current	One gallon per minute, one cubic foot per minute, etc.	Ampere One coulomb per second
Pressure	Pounds per square inch or pounds per square foot	Volt
Resistance	No unit	Ohm

When a current of water is to be produced in a pipe, the one thing above all others which must be present in the circuit is the

pressure. The pressure in the circuit shown in Fig. 9 is produced by means of the pump. The circuit may be blocked by means of a valve and there will be no current regardless of the value of the pressure. If the valve be opened or the circuit completed, there will be no flow of water in the circuit unless there is a pressure acting in the circuit.

The same general conditions exist in the case of the electrical circuit. If the wire forming the circuit be broken, or if the circuit is opened at a switch, as shown in Fig. 10, there will be no current in the circuit regardless of the value of the pressure. If the circuit be completed, there will be no current unless there is an electrical pressure acting in the circuit. It is thus seen that it is imperative that there must be a pressure acting in every closed circuit in order that there be a current in the circuit.

The electrical pressure for practical purposes on the motor car may be produced by chemical action as in the primary and storage battery, or by electromagnetic induction as in the generator. Both of these methods will be discussed in detail in two of the following sections.

Relation of Current, Pressure and Resistance

The current in an electrical circuit increases with an increase in pressure, provided the resistance of the circuit does not increase in value faster than the pressure. If the resistance of the circuit remains constant, the current in the circuit will increase and decrease directly as the pressure; that is, if the pressure acting in the circuit be doubled, the current in the circuit will be increased to twice the original value, and if the pressure be decreased in value, say, to one-half its original value, the current will decrease in value to one-half its original value.

The current in an electrical circuit decreases with an increase in resistance, provided the pressure in the circuit does not increase in value faster than the resistance. If the pressure in the circuit remains constant, the current in the circuit will vary in value inversely as the resistance of the circuit; that is, if the resistance of the circuit be doubled, the current in the circuit will decrease to one-half of its original value, and if the resistance be decreased in value, say, to one-fourth of its original value, the current will increase in value to four times its original value.

The above relations between current, pressure and resistance are stated as follows:

Current varies as pressure divided by resistance. When the current in the circuit is measured in amperes, the pressure in volts and the resistance in ohms, this relation between current, pressure and resistance may be stated as follows:

$$\text{current} = \text{pressure} \div \text{resistance, or}$$

$$\text{current} = \frac{\text{pressure}}{\text{resistance}}$$

$$\text{amperes} = \text{volts} \div \text{ohms, or}$$

$$\text{amperes} = \frac{\text{volts}}{\text{ohms}}$$

A storage battery is connected to a lamp as indicated in Fig. 1. The pressure produced by the battery is 6 volts and the resistance of the lamp is 12 ohms, what current will the battery produce in the lamp? By referring to the above relation between current, pressure and resistance, we see that the current is equal to the pressure in volts divided by the resistance in ohms, and if we replace "pressure" by the value of the pressure in volts and "resistance" by the value of the resistance in ohms, we may determine the value of the current in amperes as follows:

$$\text{current} = \frac{\text{pressure}}{\text{resistance}}, \text{ or } \text{current} = \frac{6}{12} = \frac{1}{2} \text{ ampere}$$

If the current in a circuit and the pressure producing the current are both known, then the resistance of the circuit may be determined as follows: Since the current is equal to the pressure

divided by the resistance, we may write the resistance equal to pressure divided by the current as follows:

$$\text{resistance} = \text{pressure} \div \text{current, or}$$

$$\text{resistance} = \frac{\text{pressure}}{\text{current}}$$

$$\text{ohms} = \text{volts} \div \text{amperes, or}$$

$$\text{ohms} = \frac{\text{amperes}}{\text{volts}}$$

For example, if the pressure acting in a light circuit of a motor car is 12 volts and there is a current of 4 amperes, then the resistance of the circuit is equal to 12 divided by 4, or

$$\text{resistance} = \frac{12}{4} = 3 \text{ ohms}$$

In some cases the resistance of the circuit and the current it is desired to produce are known and the problem is to find the pressure necessary to produce this desired current. The pressure in a circuit in volts is equal to the resistance of the circuit in ohms multiplied by the current in amperes, or

$$\begin{aligned} \text{pressure} &= \text{resistance} \times \text{current} \\ \text{volts} &= \text{ohms} \times \text{amperes} \end{aligned}$$

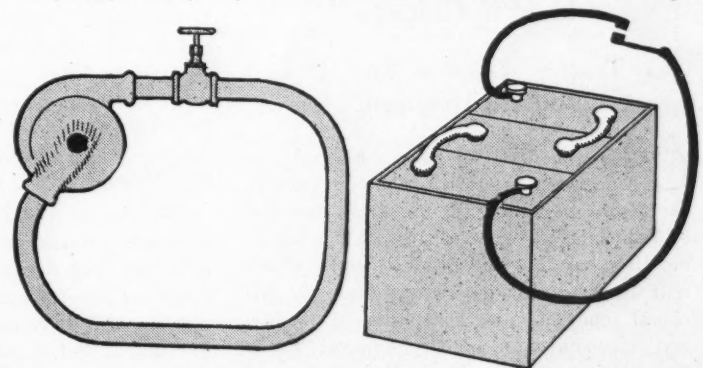
For example, if the resistance of a lamp is 3 ohms, what pressure will be required to produce a current of 2 amperes through the lamp? We may determine the value of the pressure required in volts by replacing the resistance in the last equation by the value of the resistance, the current by the value of the current and then multiplying these two quantities, thus

$$\text{pressure} = 3 \times 2 = 6 \text{ volts}$$

Conductors and Insulators

Some materials will offer less resistance or opposition to the flow of electricity through them than other materials, and for this reason they are called conductors, while those materials which offer a high opposition to the flow of electricity through them are called insulators. For example, copper, iron, brass, carbon, lead, etc., offer a comparatively low resistance to the flow of electricity through them, and hence they are called conductors.

Rubber, glass, fiber, mica, porcelain, etc., all offer a high opposition to the flow of electricity through them, and hence they are called insulators. You must get this fact clearly in mind that all materials will conduct electricity, but the conducting power of some is much better than others, and they are called conductors merely to distinguish them from the materials which are poor conductors of electricity and called insulators. The words conductor and insulator are only relative terms and the readers must not get the impression that some materials will conduct electricity and some will not. In practice, the conducting power of the ordinary insulating materials, such as rubber, porcelain, mica, etc., is so poor in comparison to the conducting power of the conductors, such as copper, brass, iron, carbon, etc., that they are said to conduct no electricity.



Figs 9 and 10—The effect of resistance. In a water circuit, if the valve is closed, there will be no flow of water, though there may be a high pressure at the pump; in the electrical circuit if the wire is cut or switch is opened there is no current, though the battery may have a high electrical pressure

The resistance offered by a pipe to the flow of water through it depends upon the size and length of the pipe. The greater the length of the pipe, the greater the resistance it will offer to the flow of water through it, and the shorter the pipe the less the resistance it will offer to the flow of water through it.

Factors Determining the Resistance of a Conductor

The resistance offered by a wire to the flow of electricity through it depends upon the length of the wire just as the resistance of the pipe depends upon the length of the pipe. The longer the wire, the greater the resistance, and the shorter the wire, the less the resistance, the size of the wire, of course, remaining constant. If the length of the wire be increased to twice its original value, its resistance will be doubled, while if its length be reduced, say to one-third its original length, the resistance will be reduced to one-third its original value. In other words, there is a direct relation between the resistance of a wire and its length.

If the area of a pipe be increased; that is, if the pipe be replaced by a smaller one of the same length, there will be an increase in the resistance to the flow of water, while if the area of the pipe be increased there will be a decrease in the resistance. There is a similar relation between the resistance of a wire and its area or size. If a wire of a certain length be replaced by a smaller wire of the same length and of the same kind of material as the first, there will be an increase in the resistance, while if the size of the wire be increased, there will be a decrease in the resistance.

A pump which is producing a certain pressure will cause more water to flow through a short pipe than through a large one of the same size, it also will cause more water to flow through a large pipe than through a small pipe of the same length. Likewise, a battery which produces a certain electrical pressure will cause a greater flow of electricity in a short wire than in a long wire of the same size and of the same material; it also will cause a greater flow of electricity in a large wire than in a small wire of the same length and of the same material.

The relation between the resistance of two wires of the same size and composed of the same material will be exactly the same as the relation between their lengths. That is, if one of the wires is ten times as long as the other one, then its resistance will be ten times as great as the other wire. If two wires are of the same length and composed of the same material but of different size, the relation between their resistances will be just the opposite to the relation between their areas. That is, if one wire has an area three times as large as the other one, its resistance will be one-third as great as that of the other wire.

Next Week—Part II of this series explains Series and Multiple Circuits—tells why and how batteries and lamps are connected in different ways to get different results.

The resistance of a wire depends upon the kind of material of which the wire is composed. Thus copper is a better conductor of electricity than aluminum; aluminum is better than brass; brass is better than iron; iron is better than lead, etc. A copper wire of a certain size and length will have less resistance than a brass wire of the same size and length; the brass wire will have less resistance than an iron wire of the same size and length, etc.

Since the resistance of a wire increases with an increase in length and decreases with an increase in area, we have the following relation:

The resistance of a wire varies as the length divided by the area. This relation, stated in a little different form, means that the resistance increases at the same rate that the length increases, if the area remains constant, and the resistance decreases at the same rate that the area increases. If the length and area of a wire both increase at the same rate, the resistance of the wire will remain unchanged.

Effect of Temperature on Resistance

The resistance of a wire is not constant, even though its length and area remain constant, but changes, due to a change in temperature. The change in resistance of some materials due to a change in their temperature is very small, and in some cases may be neglected. Some materials experience an increase in resistance with an increase in temperature, while there is a decrease in resistance with an increase in temperature in some. Carbon, for example, decreases in resistance with an increase in temperature, while the resistance of brass, iron, copper, etc., increases with an increase in temperature. The increase in resistance of a copper wire is approximately $\frac{2\frac{1}{2}}{100}$ of 1 per cent for each degree increase in temperature on the Fahrenheit thermometer. Thus, if a coil of copper wire has a resistance of 100 ohms at 60 degrees, its resistance at 100 degrees may be determined approximately as follows:

Multiply the change in temperature by .0022 and the result by the original resistance, if the temperature is increasing, and the result will be the increase in resistance, thus:

$$\begin{aligned} 100 - 60 &= 40 \text{ degrees change in temperature} \\ 40 \times .0022 \times 100 &= 8.8 \text{ ohms increase} \\ 100 + 8.8 &= 108.8 \text{ resistance at 100 degrees} \end{aligned}$$

In brief, the resistance of a conductor depends upon three things, and they are:

- Dimensions of the conductor (its length and area).
- The kind of material in the conductor (whether it is copper, brass, iron, etc.).
- The temperature of the conductor.

Gas Engineers Convene

Annual Meeting of N. G. E. A.
Held in Chicago

Gas Tractor Engines and Design
Will Be Discussed

CHICAGO, June 27—The National Gas Engine Association today convened at the Hotel Sherman for its annual session of 3 days. One of the features of this year's meeting will be the annual dinner which will be attended by several men of national reputation, such as Edward J. Hurley, vice-chairman of the Federal Trade Commission, and Dr. W. C. Huntington, of the bureau of Foreign and Domestic Commerce.

One of the most interesting sessions will be that of Wednesday morning, June 28,

when three papers will be read on gasoline tractors. "Tractor Engines" is the subject of W. J. McVicker's paper. Mr. McVicker is president of the engineering company bearing his name, located at Minneapolis. William A. Horthy, of the engineering department of the International Harvester Co., Chicago, has as the subject of his paper "Tractor Design." The third paper will be "Tractor Drawbar Ratings," by Raymond Olney, editor of Gas Power.

The Thursday afternoon session will be of timely interest inasmuch as it will deal with the fuel situation. E. E. Grant, secretary of the Independent Oil Men's Association, will talk on this subject. "C carburetion" is the subject of the paper to be given by E. E. Dean, chief engineer of the Byrne Kingston Co., Kokomo, Ind. E. W. Roberts, managing editor of Gas Engine, will discuss "Liquid Fuels, Present and Future."

Dixie Booster Tour

Florida Motorists to Visit Neighbors
"Up the Street"

Leesburg Citizens to Travel Highway to North

ATLANTA, Ga., June 26—The first town booster trip by motor in history, passing through any considerable number of states, starts north from Florida this week. It will be made up of leading citizens of Leesburg, Lake county, Fla., who will travel the entire length of the Dixie highway, inviting people along the route to visit them in their own home town.

Every town and hamlet between Leesburg and Chicago will be visited, and 160 residents of Lake county are planning to make the trip. The Lake county citizens

have announced they intend to make the motor junket over the length of the country an annual affair. They expect it to prove of inestimable value in promoting closer relations between the people of the different states through which the Dixie highway passes.

C. C. Roe, of Leesburg, is chairman of the committee in charge of the trip. The Dixie Highway, he insists, brings the people of the different states so closely together that he and his confreres from Lake county are only going to visit their neighbors "up the street."

The tour will begin June 28, and stops will be made at Lake City, Tallahassee, in Florida; Albany, Macon and Atlanta, in Georgia; Chattanooga, Monteagle and Nashville, in Tennessee; Louisville; French Lick and Indianapolis, in Indiana.

NEW CAR INSURANCE FIRM

Dallas, Tex., June 26—The Automobile Underwriters of America has been organized in Dallas for the purpose of writing automobile insurance of all kinds, with the hope of saving the automobile owner a considerable sum of money on that item.

Sioux City Race July 4 Has Prizes on Co-operative Plan

SIoux CITY, Ia., June 26—Because of the many unusual features incorporated in the event, as well as through the prominence of the drivers and cars entered, the Sioux City speedway races July 4 will attract more attention this year than ever before. The idea under which the races are to be held this season is an original one for which General Manager E. E. Schultz, of the Sioux City Motor speedway is responsible. He evolved the plan and then submitted it to a meeting of the drivers at Chicago the week prior to the races there and received their unqualified support.

The plan in brief is the drivers and the promoters are to split the gross receipts, each to get an equal portion. Out of the drivers' share comes nothing but the purses, distributed pro rata as the drivers finish. The promoters must pay all the expenses incident to the staging of the race and must also pay the freight on the cars that enter the event.

That the idea is a good one is best shown by the fact that Ralph Mulford, Ira Vail, Billie Chandler, J. J. Rawlins and Wilbur D'Alene have filed their entries. The four named came in on the first 2 days after the announcement that the list was open.

The races this year, instead of being one 300-mile grind, have been made shorter. There are to be three events during the day. The first one a 10-mile dash, the second one a 20-mile contest and the third, the feature 100-mile race for the major portion of the prize money.

Cherry Circle Wins Cup

Chicago Athletic Association Wins Ninth Annual Interclub Reliability Run

Automobile Club Defeated in Windy City Classic

CHICAGO, June 26—The Chicago Athletic Association won the Ninth Annual Inter-Club Reliability Contest from the Chicago Automobile Club in the 2-day run to Indianapolis and return, the score standing 277 points penalty for the C. A. A. and 605 points penalty for the C. A. C.

This was the ninth yearly event of the inter-club classic in which the Cherry Circle has won six times from the Chicago Automobile Club. The contest is in the form of a team match, picked drivers from the two clubs competing and penalties being assessed for work on the car except tires, motor stops, taking on supplies outside of controls, if under 100 miles, and lateness at controls.

Conditions of the run were somewhat more stringent than those of previous years as a 22½-mile-an-hour schedule was maintained on the first day and a 25-mile-an-hour schedule on the second day. Heretofore the average speed has been limited to 20 miles per hour. However, the excellent roads through Indiana made it possible to cut down the running time. The total distance was over 200 miles each day. On the return trip the tourists took lunch with George Ade at his country home, Hazleton, near Kentland, Ind.

Sixteen Contesting Cars

There were sixteen contesting cars on the run, eight on each team, and of these nine checked in with perfect scores. A feature of the event was the fact that the teams were captained by brothers, G. E. Hibben leading the C. A. C. contestants, and S. E. Hibben the C. A. A. delegation.

The standing at the end of the run follows:

CHICAGO AUTOMOBILE CLUB			
	1st day	2d day	Total
G. F. Ballou, Packard....	5	*	5
J. T. Brown, Moline....	*	200	200
W. M. Gelderman, Cole..	*	*	*
A. N. Eastman, Mitchell..	*	*	*
F. E. Lammert, Cole....	*	*	*
H. W. Merscheck, Packard.	*	*	*
E. A. Turner, Chandler...	*	*	*
G. E. Hibben.....	300	100	400
	305	300	605

* Perfect.

CHICAGO ATHLETIC ASSOCIATION			
	1st day	2d day	Total
F. W. Wentworth, Packard	5	*	5
W. H. Slepeck.....	200	5	205
W. G. Beek.....	30	32	62
F. X. Mudd, Franklin....	*	5	5
F. A. Hill, Jr., Packard..	*	*	*
C. R. Forrester, Marmon..	*	*	*
Sidney Smith, Hudson...	*	*	*
S. E. Hibben, Packard...	*	*	*
	235	42	277

* Perfect.

MARMON STANDS PAT

Indianapolis, Ind., June 26—No changes will be made in the Marmon 34 for 1917.

The present model will be continued throughout next year with possibly a few minor refinements in detail.

The Marmon 34 was first introduced to the motoring public at the New York show in the early part of January, 1916. The extensive use of aluminum and unusual frame construction are the features of the car.

The frame, for instance, is of deep section and the body, which is aluminum and in three sections, rests directly on it. The makeup of the motor, which is the valve-in-head type, is largely of aluminum. The result is that the Marmon 34 seven-passenger touring car ready for the road, although a high-grade car in every particular, weighs only 3,540 pounds.

HUDSON WINS COAST CLIMB

Tacoma, Wash., June 23—In the hill-climbing contest in Dayton, Wash., a Hudson Super-six driven by John D. Moore, made the ½-mile climb in 1 minute and 4 seconds. The grade is from 15 to 30 per cent. A Paige was second in 1 minute and 22 seconds and an Overland third in 1 minute 36 seconds.

Winner of 1913 Glidden Enters Same Car in Park Tour

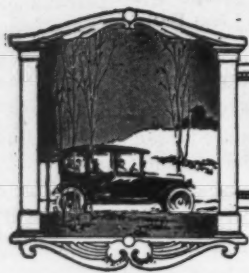
MINNEAPOLIS, Minn., June 24—Dr. J. D. Parks, of Duluth, winner of the 1913 Glidden tour and vice-president of the Minnesota State Automobile Association, is the latest to enter the sociability motor car tour that starts for Yellowstone National Park on July 20. He will man the same car that was driven in the national reliability tour three years ago.

While this machine is of 1908 vintage, Dr. Parks declares it will make the trip to Gardiner with the best of them.

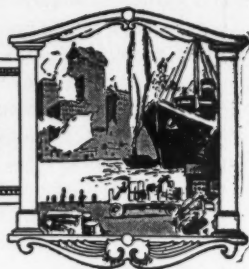
BAY STATE A. A. HAS RUN

Boston, Mass., June 26—The annual outing of the Bay State A. A., which comprises all the prominent motor and accessory dealers in Boston, ended last night when they motored back from Lake Spoford, N. H., after a 3 days' trip. There were about 200 men and women present and they went in fifty cars. They left Boston Friday noon and going through New Hampshire some of the veterans of the earlier Glidden tours got a taste of the same sort of roads that brought disaster to men and cars. Friday evening there was dancing until midnight.

Saturday the opening golf matches were played and in the afternoon there was a series of gymkhana sports for men and women. It was interesting to see some of the prominent dealers falling into the mud or rolling on the ground as they tried to go through various stunts. Saturday night there was a banquet and a ball, both of which were very lively. There were more than 100 prizes awarded.



EDITORIAL PERSPECTIVES



Front-Seat Sanitation

STAND on a busy corner any hot summer's day and watch the cars go by. First let us suppose a machine in the \$400 class comes along. There is a fat man sitting next to the driver and he is mopping the perspiration from his brow with his left hand and holding the front door open with his right.

✻ ✻

A LONG comes another car. This one is in the \$2,000 class. This is a suppositional comparison and so we will put another fat man in the front seat of this car. What is he doing? He is wiping the perspiration from his brow with his left hand and holding the door open with his right. The fat man is used in this comparison because his particular kind is, traditionally, especially susceptible to the influence of heat, but a thin man or woman might suffer just as much, although the evidence would be more hidden.

✻ ✻

THE point is that the modern car of almost every make, whether it sells for \$400 or \$3,000 has a fireless-cooking front seat in the summer months. Would the engineers who design those cars

go to bed on a hot, sultry night with a gas stove going full blast beside them? Then why should they impose such a similar inconvenience upon the car purchasers? The conditions are very much alike.

✻ ✻

THERE has been some feeble effort made along the line of designing motor cars to properly ventilate the front seats, but at the best, only makeshift appliances have made their appearance and for some unknown reason, the manufacturers of these have, in several instances, abandoned them.

✻ ✻

IT is a peculiar fact that motor cars originally were designed for summer driving only. In late years a wave of popularity for winter equipment has swept the country, and the engineers have devised every imaginable convenience to apply to this type of car. Yet the present summer touring car has the same front-seat boiling proclivities as had the first fore-door car of 8 years ago. It is high time for a conscientious movement towards front-seat sanitation.

Motor Cars and Good Roads

THE enormous increase in motor car traffic is bound to affect favorably the condition of the public roads of the country as the number of cars and the revenues increase. In the good old patient days when the horse-drawn vehicle was the only means of transportation in the rural districts and time was no object to the people, who took things as they were, it did not seem to matter very much how many holes and ruts and swampy places there were on the roads to market; but it is different now and the motor cars are making smooth and substantial highways necessary to their favorable progress and to the success of business. It is worth noting that from the time of the old Cumberland highway surveyed by Washington and built by the national government, it was not until the motor car had come and proved its practical value that there was any serious thought of inter-state and trans-continental highways that would hold the country together in the closest neighborhood. It was not until wise men at the capitol discovered the rural free delivery postal routes, that a constitutional way was found to make the government at Washington an active partner in the enterprise of building good roads for the health of the nation. In 1905 there were 48,000 motor cars, including commercial vehicles, in the United States, according to the registration statistics assembled by the Division of Road Economics of the

United States Office of Public Roads and Rural Engineering; in 1915 there were 2,445,664. This was an increase of 5,000 per cent.

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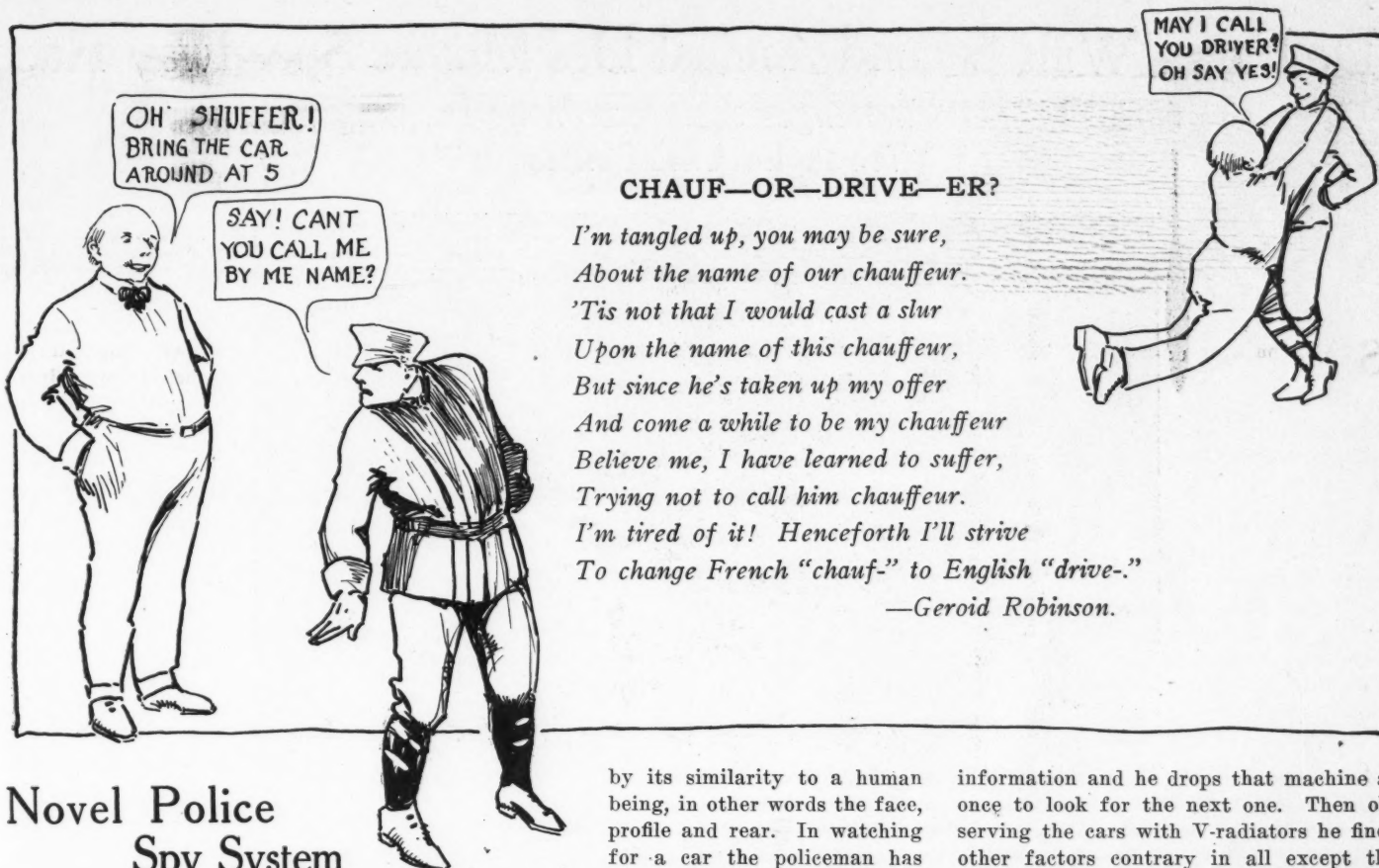
TEN years ago, of the expenditures on account of building roads and bridges in the United States less than three-tenths of one per cent was derived from the tax on motor vehicles; last year nearly 7 per cent of the money available for this purpose was derived from this source. In 1901 the first revenue derived by any of the states from motor car revenues was collected in New York state and amounted to only \$954. Other states followed the example of New York, requiring a registration of motor cars, chauffeurs and operators, until in 1905 the total amount collected in all the states on this account aggregated \$62,500; last year the revenues from this source amounted to \$18,245,713. In nearly all the states practically 90 per cent of the motor car revenues was applied in 1915 to road work and 70 per cent of this sum was expended under the control and supervision of the state highway departments. In forty-two states all, or a large part, of the revenue from motor cars must be expended for the construction, improvement or maintenance of the public roads, or for the maintenance of the state highway departments. In six states this requirement is not made.

Not First Cost; But Upkeep

NO matter how much care is spent in the selection of a suit of clothes, or a motor car or anything else used daily, it is bound to wear out. But if such things are kept in good condition they last longer and give more satisfaction than when no care is given to them. Improved roads need care for just the same reason. If the travel tears a little hole in the surface of a bituminous road, the hole will be rapidly enlarged unless it is patched. Sometimes this patching is put off too long, and everybody using the road calls it a failure, when the trouble was not due to the original road but rather to the poor housekeeping, which allowed the tears to go unattended too long.

Marking State Roads

THE state of New Hampshire does not wish the traveler over its roads to lose his way and so it has marked posts and poles along the main roads in such manner that they serve as official guides. For instance, if the traveler notices that the telephone poles have a blue band 12 inches wide with 2-inch white borders, he can rest assured he is on the main road running north through the western part of the state from Massachusetts boundary. If the poles carry a 6-inch green band and a 6-inch yellow band, with 2-inch black borders, then there can be no question that it is the Suncock Valley road that is being followed. The convenience of such a system is obvious.



Novel Police Spy System

Men on Outlet Posts of New York Learn Car's Physical Points

All Makes Differ in Appearance and Each Car Has Its Dis- tinguishing Marks

NEW YORK, June 27—New York's police are being trained to identify motor cars by their physical characteristics so that a car that is "wanted" may be picked up even though it was impossible to get its number. All the outlet posts of the city are connected with a single alarm system and the description of stolen cars, cars containing criminals, or those looked for by the officials for any other reason, are communicated.

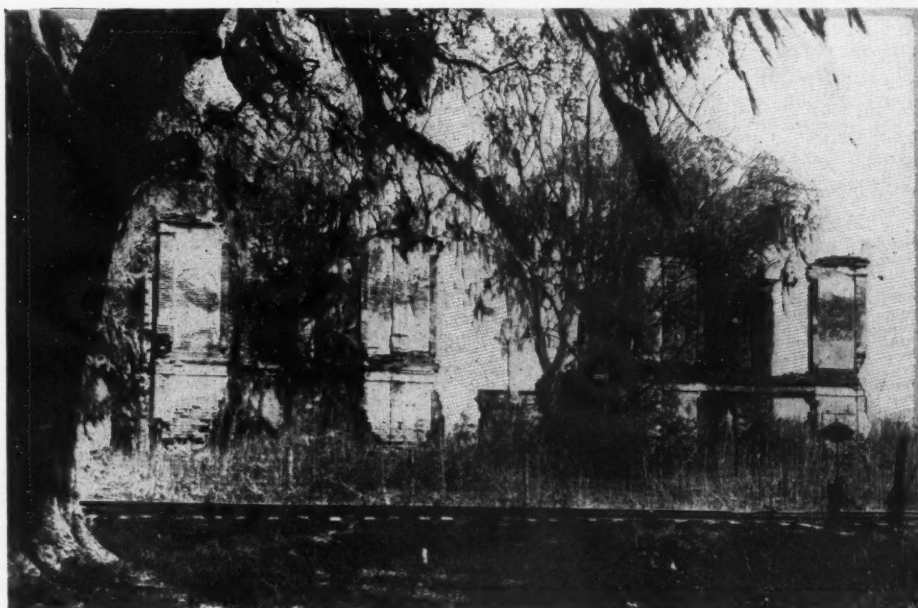
The importance of training these outlet men, or in other words the men stationed on the borders of the city on the roads which lead into other states, is obvious. Eventually every man on the force will receive the instructions and a short course has been incorporated into the training school for the police recruits.

For the aid of these 250 or more policemen who guard the ferries, bridges and main roads, the characteristics of the different makes of cars have been compared and the individual features, or factors of identification, carefully sorted. Factors of value in identifying which may be found on any car are: Fenders, headlights, radiators, hoods, tire carriers, springs, etc.

To simplify matters the car is compared

by its similarity to a human being, in other words the face, profile and rear. In watching for a car the policeman has this set list of factors in mind and checks them off one by one. If, for instance, a warning is sent out to look for a car having a V-radiator, one glimpse of a flat radiator equipped car is sufficient

information and he drops that machine at once to look for the next one. Then observing the cars with V-radiators he finds other factors contrary in all except the one which he is especially looking for. Thus he catches the offender by the process of elimination, and so accurate is the system proving that many arrests have already been made.



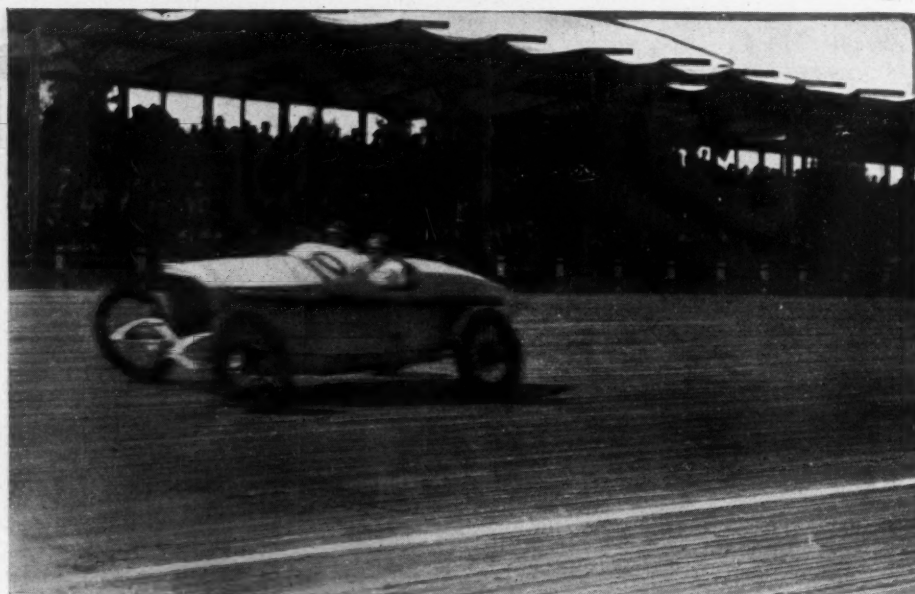
EDITOR'S NOTE—This is the eighty-fourth of a series of illustrations and thumb nail sketches of the scenic and historic wonders of America to be published in Motor Age for the purpose of calling the attention of motorists to the points of interest in their own country.

NO. 84—RUINS OF PAKENHAM'S HEADQUARTERS

AN engagement was fought on Jan. 8, 1815, between a force of 12,000 British under Sir Edward Pakenham, and one of 6,000 Americans under General Andrew Jackson. The latter was in a strongly entrenched position and awaited Pakenham's assault on his lines. The battle lasted only 25 minutes, when the British fled, leaving behind them 2,600 killed and wounded. Pakenham had headquarters in a building near New Orleans, the ruins of which are shown above. He led the charge himself and was killed.

De Palma Wins Second Annual Des Moines Speedway Race

Rickenbacher Challenges the Veteran in Thrilling Duel
Throughout the Contest



De Palma and his Mercedes at the finish of the Des Moines race

DES MOINES, Ia., June 24—Ralph de Palma won the second annual Des Moines speedway race here today when he went 150 miles in 1 hour 36 minutes and 36.23 seconds, or at the rate of 92.2 miles per hour, a speed nearly 6 miles per hour faster than that of the Des Moines race last year, for a distance of 300 miles in which de Palma was nosed out of first place by Ralph Mulford in a Duesenberg.

Next to de Palma's Mercedes came the two Maxwells which captured second and third places. Rickenbacher, who was the only man to head de Palma during the entire race and who pushed him for the lead during the first 140 miles of the race, was robbed of his apparently sure second by a series of tire troubles late in the grind.

But his teammate, Pete Henderson, was at his heels and picked up Rickenbacher's place just in the wake of the Mercedes. Henderson, driving a great race through-

out, was second in 1:38:13.72, 1 minute and 24 seconds behind de Palma. Rickenbacher, in spite of his troubles, got the checkered flag just 9 seconds behind Henderson when he finished in 1:39:18.72. Dave Lewis in the Crawford took fourth honors when he finished in 1:40:00.01. Joe Cooper and his Stutz were fifth and Ralph Mulford, Des Moines winner last year, with a Duesenberg, could not get better than sixth this year with the Hudson Super-six which he is now driving. Galvin in his Sunbeam was seventh and Chandler, Joe Cooper's teammate, was eighth.

Two Spills Give Thrills

Two spills, almost coincident and the second directly resultant from the first, failed to mar the race which Starter Wagner declares to have been an ideal contest under ideal conditions. Wilbur D'Alene, one of the Duesenberg team, had his right rear wheel collapse on the last turn of his thirtieth lap. The car leaped into the

outer guard rail, rebounded, struck the rail again and then tore downwards into the safety apron where it landed right side up with neither D'Alene or his mechanic, Ed Miller, injured.

Tom Milton, another of the Duesenberg pilots, was just back of D'Alene and took to the safety apron at high speed to avoid mixing with his troubled comrade ahead. His car spurned the rough earth of the apron and turned over several times. Milton and his mechanic, E. Rathbun, were both under the cowl and both came out unscathed. The accident, however, took all of the Duesenberg contenders from the field except Eddie O'Donnell, who was out in the eighty-sixth lap when his steering gear went wrong.

De Palma won by master work at the wheel and was more fortunate than usual for him in the matter of tire changes. He was called to the pit but once and that was in the one hundred and twenty-ninth

Times of Contenders Each 10 Miles in Des Moines Race

No.	Car and driver	20	40	60	80	100	120	140	150	M.P.H.
10	Mercedes, de Palma.....	12:36	25:37	38:36	51:28	1:04:09	1:16:49	1:30:11	1:36:36.23	92.6
3	Maxwell, Henderson	13:15	26:35	39:52	52:57	1:06:01	1:18:50	1:31:39	1:38:13.72	91.2
12	Maxwell, Rickenbacher.....	12:39	25:38	38:36	51:29	1:04:09	1:18:04	1:31:31	1:39:18.72	90.4
20	Crawford, Lewis	13:16	27:04	39:58	52:48	1:05:42	1:19:46	1:32:34	1:40:00.01	90.0
18	Stutz, Cooper	14:36	27:37	40:33	53:26	1:07:14	1:20:04	1:33:42	1:40:08.96	89.9
14	Hudson, Mulford	13:52	27:47	41:52	55:54	1:10:08	1:24:17	1:38:02	1:45:27.15	86.3
7	Sunbeam, Galvin	13:39	27:09	42:08	55:44	1:09:21	1:23:01	1:36:35	1:46:44.40	85.5
15	Crawford, Chandler	14:25	27:52	42:14	56:27	1:16:53	1:31:50	1:46:47	Flagged	
22	Duesenberg, O'Donnell	12:52	26:27	39:57	53:34					

lap when his right front tire gave out. The change was made in 20 seconds. Rickenbacher was not so fortunate with his tires. His first trouble sent him to the pits in the one hundred and eighth lap after he and de Palma had driven almost a neck-and-neck race up to that time. His second tire change came in the one hundred and thirty-sixth lap and he went in for a new tire for the third and last time in the one hundred and forty-second mile. De Palma gained two and a half laps when Rickenbacher went in for the first change and he held a margin over his rival during the remainder of the race to the finish flag.

De Palma led with Rickenbacher pushing him at every turn of the race until Rick pushed his Maxwell into the lead in the eighty-seventh mile. He held the leadership for a short time only, however, for de Palma soon pushed his Mercedes into the head position again on the lower turn of the ninety-fourth mile. During the early stages of the race Galvin and his Sunbeam alternated with Henderson and his Maxwell for the third and fourth places except during the time before D'Alene was

put out of the race when Galvin held the fourth place.

Twelve cars went away when Fred J. Wagner waved the red flag at 1:50 with 20,000 people assembled for the event. De Palma and Rickenbacher at once took the lead and the great race between them was fought out mile after mile with honors almost even but with de Palma always in the lead until the race was half over.

Quick work was the rule of the pits. Dave Lewis and his Crawford got a new tire in 30 seconds. Chandler, driving the other Crawford, was more seriously delayed by spark plug trouble.

Eddie Rickenbacher turned the tables on de Palma in the 50-mile event which followed the main race. He went the entire distance without a call at the pits and his time was 31 minutes and 9.17 seconds or an average of 96 miles an hour. De Palma was only seconds behind him, 9 of them in fact, although he had lost 18 seconds in a tire change. Rickenbacher's margin, however, would have been much larger except for the fact that he had a bad skid in the back stretch. This thrill was missed by the crowd but was observed

by de Palma, who knew that Rickenbacher lost time by reason thereof and who thought he had won the race until it was all over. A rechecking of the tape showed that Rickenbacher was the winner. When he had the bad skid in the back stretch he could not keep his car from the rough and cut a figure eight, but managed to right himself and swing back into his wonderful speed. The delay caused him a temporary drop from the first to the fourth position.

The 50-mile event was, if possible, even a more exciting and satisfying spectacle than the longer race. Three, instead of two, drivers were fighting for the first place in every mile of the grind. Rickenbacher and de Palma were at it again and they were both being fought at every stage of the game by Joe Cooper and his Stutz, who took the third place and who was a leader at one stage of the game until tire trouble put him back. Lewis and his Crawford registered again when they won the fourth position in the shorter race and Henderson, second man in the 150-mile race, was fifth, with Galvin and his Sunbeam registering in for the sixth position.

Lesser Lights Win While Veterans Fail at Galesburg

GALESBURG, Ill., June 22—This was a day in which lesser lights showed in front, while star drivers fell by the wayside. Following two postponements, caused by rain, the third annual 100-mile race was held on Galesburg's mile dirt track and Otto Henning, driving an Ogren car, won first money. Owing to the condition of the course the time was slow, 1:41:31.75, an average of 58.5 miles per hour.

Second to the winner came George Buzane in a Duesenberg. His time was 1:43:15.05, an average of 58.2 miles per hour. Andy Burt in a Stutz was third in 1:44:20.75, an average of 57.5 miles per hour, while Art Klein in a Klein Special was fourth in 1:45:22.20, an average of 57 miles per hour. Klein was the hard-luck driver of the contest, for he lost the race after leading the field for 87 miles.

Ralph Mulford and Ira Vail, both driving Hudson super sixes, were put out of the race early by mechanical troubles. Mulford broke a valve spring and piston and Vail burned out a bearing. Other drivers who competed but who failed to get inside the money were Jack Gable in the Burman Special, Harry McNay in a Cino, Tommy Milton in a Mercer Special, and C. R. Parker in a Duesenberg.

Henning was lucky. He went in as a post entry, reached Galesburg after a hard drive of 2 days over muddy roads and then had failed to show up when Starter Fred J. Wagner had the field lined up for the start. Referee Clifford Ireland and Starter Wagner held the race for 5 minutes and just as the motors had been cranked for the getaway Henning appeared. With-out time to even visit his pit, the Chicago

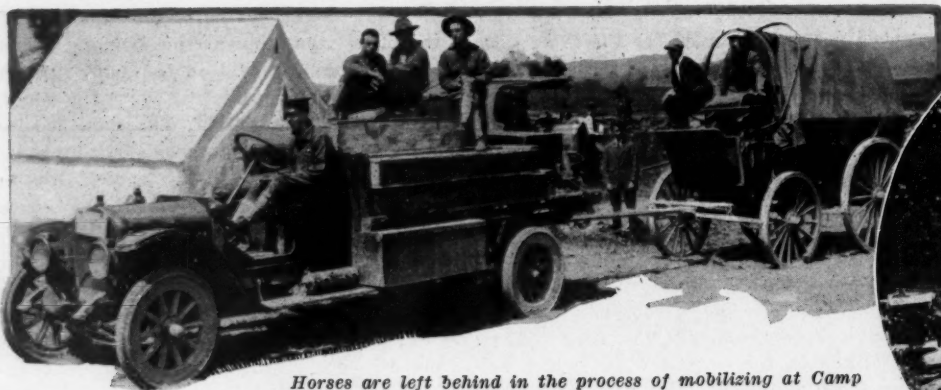
driver got away in last place. Then he drove one of the greatest races ever seen on a dirt track. He chased Klein so hard that the leader began coming back to him at the half-way mark. Klein had a lead of two laps, but this was gradually cut down until he was but a lap to the good at the 75-mile point.

Then Klein was forced to make a short stop at his pit to fix a broken terminal and Henning gained a half lap. It was neck and neck for another 15 miles, with Henning steadily gaining. Then, when Klein had to stop for a tire change that took but 31 seconds, Henning went into the lead and was not again headed. Klein's hard luck stuck with him, for he ran out of gasoline near the finish of the race and dropped back to fourth place, where he remained until the end.

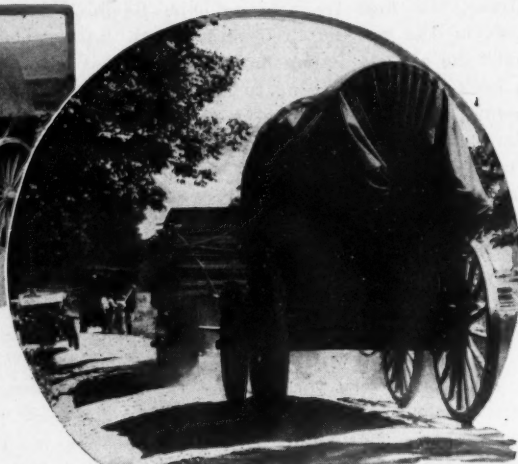
Time Made by Each Car Every 10 Miles of Galesburg Race

Driver		MILES										M.P.H.
		10	20	30	40	50	60	70	80	90	100	
Henning	9	10:18	20:20	31:34	41:31	52:23	1:02:15	1:12:13	1:22:06	1:32:09	1:42:34.60	58.5
Buzane	2	10:10	19:58	30:03	41:04	52:35	1:02:52	1:12:54	1:22:58	1:33:03	1:43:15.05	58.2
Burt	1	10:09	20:18	30:31	40:37	52:32	1:02:53	1:13:17	1:23:38	1:33:53	1:44:20.75	57.5
Klein	4	9:48	19:40	29:21	39:12	49:17	59:37	1:09:54	1:20:04	1:34:50	1:45:22.25	57.0
Vail	3	10:52	26:58	37:57	48:59	59:57	1:11:00	1:22:04	1:32:59	1:43:59	Out on 94th lap	
Gable	11	10:32	21:58	34:20	45:46	57:14	1:10:29	1:21:51	1:32:46	1:44:48	Out on 94th lap	
McNay	6	11:46	24:49	36:27	47:26	58:29	1:10:19	1:22:08	1:33:59	1:46:06	Out on 92d lap	
Milton	14	10:18	20:49	Out on	25th lap							
Parker	18	10:12	22:41	Out on	27th lap							
Mulford	24	10:21	Out on	10th lap								

"Remember the Alamo"



Horses are left behind in the process of mobilizing at Camp Whitman



NEW YORK CITY, June 24—The president's call for mobilization of the New York regulars was a cue for a remarkable display of efficiency and orderliness in getting together the soldiers of the state at Camp Whitman. Camp Whitman will be the largest mobilization station north of the border.

Motor trucks are being hired and purchased by the military authorities in large numbers and to them can be attributed the greatest factor in the rapid mobilization of the troops. By today the officers of the camp expect to have at least forty of these trucks in operation.

The supplies for the camp are brought overland from Peekskill to the camp, which is situated among the foot hills 34 miles from that city. As it is equally as far to the nearest railway station, the upkeep of the camp is entirely dependent on the motor trucks, although a few wagon trains are used for hauls which do not have to be particularly rapid.

To lighten the burdens of the trucks and assure prompt moving of the troops when the call is made, tracks are already being laid for a branch railroad which will run directly into the heart of the camp and will be used for no other purpose than to take care of the army stationed there. This new railroad will probably be complete and trains running on it within 2 weeks.



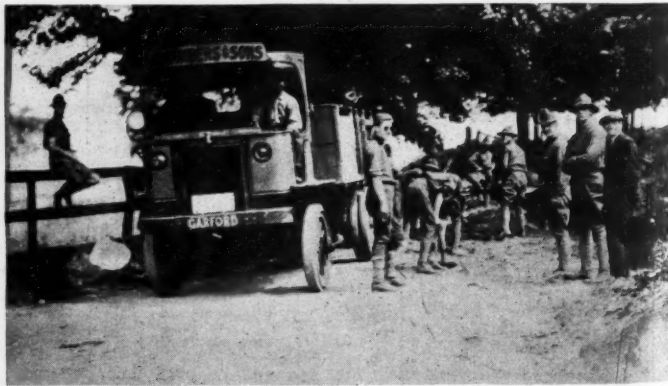
Motor truck used for rush order of lumber to Camp Whitman



The Vim Truck Co. presented a machine to the field hospital division. It is painted in the national colors of red, white and blue



To get the soldiers to camp motor trucks are used. Foodstuffs can come later in horse-drawn wagons



Engineering corps of Camp Whitman making the road passable for the motor trucks which are to follow

Non-Stop King Has Gone Over 9,100 Miles Since June 15

Striving to Complete 10,000 Miles in Two Weeks



Fred Wagner starting the King on its 10,000-mile run at Sheepshead

SHEEPSHEAD BAY, N. Y., June 27—Special telegram—Running steadily, day and night, and circling the board track at a speed of more than 30 miles per hour, the King model E stock car which started upon its non-motor stop run on Thursday, June 15, at 4 o'clock today had completed 9,100 miles of its journey. The motor has never been stopped for a second since the test started and when it comes to its close on Thursday, June 29, the engine will have run continuously for 2 weeks.

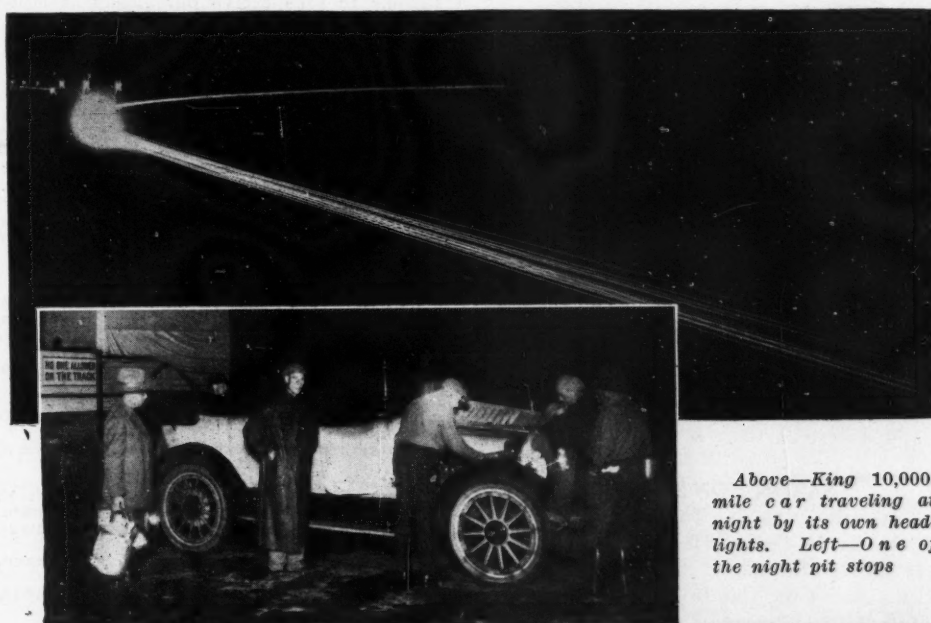
This test is designed to show the dependability of the car under conditions which are similar to those of actual use by an owner but more severe, so far as average speed is concerned and so far as continued running has its influence. In the 2 weeks of continuous motor running the car will have traveled a distance equivalent to that given in 2 years of service by the ordinary owner. At the end of the first week of travel nearly 6,000 miles had been covered or as much as the average car owner will drive in 1 year and this without a single stop of the motor. Since the car started on its journey at 12:14 on June 15, the crankshaft has not stopped revolving.

Camp at Track

In carrying out this test, the King company has established a headquarters on the speedway, having moved a corps of drivers and mechanics to the spot and also provided quarters for the American Automobile Association officials, under whose direction the test is carried on. The committee in charge is made up of F. E. Edwards, chairman, J. Edward Schipper, Harry A. Tarantous and Fred Elsner. The drivers each take the wheel for 5 hours at a stretch and have 10-hour rest between periods. The mechanics are riding under similar conditions, the same mechanic always being with the same driver. The drivers are men from the experimental and testing departments of the King factory in Detroit, and the car is one taken from the regular production in the factory and has been certified as standard stock throughout.

The entire equipment of the car also is stock even to such small details as the voltage of the lamps, etc. The car is being driven at a speed of very close to 30

miles per hour, the average being somewhat higher than that as it passes the 9,000-mile mark. The whole distance has not been covered on the board speedway as the car



Above—King 10,000-mile car traveling at night by its own headlights. Left—One of the night pit stops



Part of the A. A. A. official staff in charge of the King 10,000-mile non-motor stop run

was driven 200 miles over the roads of Long Island during the morning and afternoon of Saturday, June 24. During this time the car was off the track for 9 hours continuously and was put through touring conditions of hilly country and variable road conditions before returning to the track and continuing its circuit around the same bowl which has staged the Astor cup.

The windshield is up and, in addition to the driver and mechanic in the front seat, the tonneau of the car is ballasted with sand bags to represent a passenger load. The top is in place but is carried in its down or closed position and an extra tire and rim is carried on the rear so that throughout from one end to the other the entire car is in the same condition as it would be placed on the road by the ordinary owner.

At the conclusion of the test the engine will be torn down and rechecked for the information of the A. A. A. and also for engineering inspection by the King company. During the course of the run there has been no decrease in power of the engine. As a matter of fact, while on the track the car has been driven with the hand throttle and for the same throttle opening, higher speeds have been made than at the start.

The tire equipment of the car is exactly the same as stock with Firestone plain tread in front and Firestone non-skids in the rear. The extra tire carried is a Firestone non-skid. The gear ratio is also standard and, while traveling, the lamps are carried lit for a large percentage of the time giving the lighting system as rigid a test as the other parts of the car.

The stock equipment of the car includes Willard storage battery, Atwater-Kent distributor, Ward-Leonard two-unit starting and lighting system, Stewart vacuum tank, and American Gear & Mfg. Co. axles.

SAXON NON-STOP RUN

Detroit, June 24—The Saxon Motor Car Corp. has laid plans for the staging of what is said to be one of the largest non-stop runs ever held, this to be a test conducted July 1 in all parts of the country by the 2,000 Saxon dealers who will each run 300 miles without stopping his motor. The tests will be conducted individually by the dealers.

ENGINEERS REPRODUCE BURLESQUE

Detroit, June 26—The Detroit Section of the Society of Automobile Engineers decided to produce again the five-act melodrama that was given by the Section on the Noronic during this year's 4 day boat trip of the society, and which proved to be one of the hits of the entertainment program. The little play bears the imposing title of the "Trials of Gwendolyne, or Snatching Victory from the Jaws of Defeat." Arrangements have been made to give the play in the Lyceum Theatre on July 7. Russel Huff, K. W. Zimmerschied and G. W. Dunham are in the cast.

League Head Indicted

Bidwell Charged with Fraud by Government

President of Tire and Accessories Association Accused of Shady Stock Sales

BUFFALO, N. Y., June 24—Alfred C. Bidwell, president of the International Automobile League, Inc., and the International Automobile League Tire Co. of California, has been indicted by a federal grand jury at Rochester for alleged misuse of the United States mails. Two indictments were returned against Bidwell. One charges that he actually used the mails for the promotion of a scheme to defraud and the other charges that he conspired to use the mails to defraud. There are several counts in each indictment.

Federal authorities claim that the indictments are based upon letters, in which it is claimed Bidwell made false representations to prospective purchasers of stock in the tire company. These false representations consisted, it is said, of inform-

ing the persons, who were expected to buy the stock, that they would be able to buy tires at the cost of manufacture.

The government officials allege that his misrepresentations concerning the league comprised statements declaring that it had a membership of 65,000 persons, each of whom paid \$10 annually for the purchase of tires at greatly reduced prices.

They further claimed that in inducing persons to purchase stock in the tire company Bidwell submitted a prospectus showing that it was intended to divide the continent into five zones, one in Canada, and establishing factories in each of these zones; that orders received by the International Automobile League from its members would keep a modern tire plant busy; that estimated membership of the league was 65,000 and that each member used five tires annually making a total of 325,000 tires to be sold to those members.

On the assumption that each zone would have 35,000 members, Bidwell, according to the prospectus, figured that there would be a gross profit of \$11 on each tire, and that the gross earnings for four zones, excluding the Canadian zone, would amount to \$7,700,000.

The government claims that these representations were false and that the tire companies he stated were to be established were never built and that what tires were sold were purchased from another company and were of a cheap grade.

The federal statutes provide a penalty of not more than a fine of \$10,000 and not more than two years' imprisonment or both for conspiracy to use the mails to defraud.

UNIONTOWN HILL CLIMB

Uniontown, Pa., June 27—With an entry list that promises to top the one last year in both the number of cars and drivers of country-wide fame, and a purse that will top the one last year by a little more than \$1,000, the fourth annual hill climb will be held here July 20, on the mountain course between Topwood and the Summit.

The Uniontown Motoring Association will conduct the affair, assisted by F. H. Rosboro, who has been appointed official representative of the American Automobile Association.

The course that is to be used is the part of the old National Pike, and the distance is just 3 miles. Last year, C. W. Johnson, driving his own Packard car, the "Greyhound," set a record for the course for the all-event, making the 3 miles in 3 minutes, 27½ seconds, for an average of nearly 60 miles an hour over the entire course.

There will be three motor car events and one motorcycle event this season. The first event will be for small cars having a piston displacement of 231 cubic inches or under. The second will be for cars with a displacement of 300 cubic inches or under, while the third event will be the open event for all cars.

Racing Events

July 4—Minneapolis speedway race.
July 4—Sioux City speedway race.
*July 4—Track meet, Coeur d'Alene, Ida.
*July 4—Track meet, Benton Harbor, Mich.
July 4—Road race, Visalla, Cal.
July 4—Track meet, Elmira, N. Y.
July 15—Omaha, Neb., speedway race.
July 15—Track meet, North Yakima, Wash.
July—100-mile track meet, Burlington, Ia.
August 5—Tacoma, Washington, speedway races.
*August 11-12—Hillclimb, Pike's Peak, Colo.
August 12—Track meet, Portland, Ore.
August 18-19—Elgin road race.
August 26—100-mile track meet, Kalamazoo, Mich.
*September 1-2—24-hour race, Sheepshead Bay.
Sept. 4—Track meet, Newark, N. J.
September 4—Track meet, Elmira, N. Y.
September 4—Indianapolis speedway race.
September 4—Des Moines, Ia., speedway race.
September 4-5—Track meet, Spokane, Wash.
September 16—Speedway race, Providence, R. I.
September 29—Track meet, Trenton, N. J.
September 30—New York, Sheepshead Bay speedway race.
October 7—Philadelphia speedway race.
October 7—Omaha speedway race.
October 14—Chicago speedway race.
October 19—Indianapolis speedway race.
October 21—Track meet, Kalamazoo, Mich.
November 16—Vanderbilt cup race, Santa Monica, Cal.
November 18—Grand Prize race, Santa Monica, Cal.

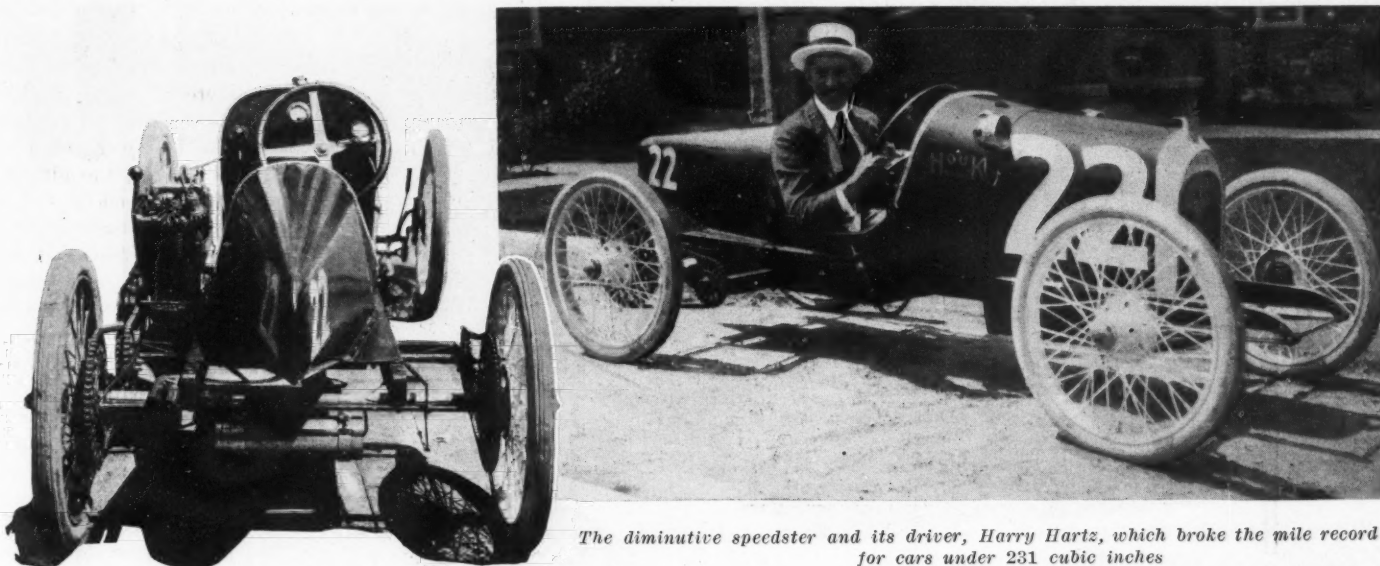
*Sanctioned by A. A. A.

TWIN CITIES, JULY 4

DRIVER	CAR
Ralph Mulford	Peugeot
Johnny Aitken	Peugeot
Ralph DePalma	Mercedes
Gil Anderson	Premier
Jack Gable	Burman Special
Eddie O'Donnell	Duesenberg
Tom Milton	Duesenberg
Howard Wilcox	Premier
C. Ostewig	Ostewig Special
Gaston Morris	Peusun
C. Christaenes	Sunbeam
F. Galvin	Sunbeam
Eddie Rickenbacker	Maxwell
Pete Henderson	Maxwell
M. Sorenson	Duesenberg
C. J. Gilbert	Mercer
Harry Feichtenberg	Marquette Buick

Harry Hartz Defends Title as Champion Junior Driver

His Time of 1 Mile in 54 Seconds Unofficially Breaks
Miniature Car Record



The diminutive speedster and its driver, Harry Hartz, which broke the mile record for cars under 231 cubic inches

LOS ANGELES, June 27—During the motor car races given by the moving picture profession at the Ascot speedway by Harry Hartz, master junior driver of the world, Hartz succeeded in turning the mile oval in 54 seconds, the fastest time ever made by a miniature car.

Hartz is the foremost junior racing driver on the Pacific coast and has been working for some time on the car with which he made the fast time. The new car, which he calls the Houk Special and which is sponsored by George W. Houk, millionaire wire wheel maker, weighs only 350 pounds and is driven by a motorcycle engine.

From present indications this mark breaks the world's light car record. This record for cars under 231 cubic inches is 56 seconds. Hartz has been working out several theories of his own for the past 6 months and the car with which he established this mark is the culmination.

The time was taken by E. H. Pendleton, official timer for the American Automobile Association. Hartz' performance was not recorded with the electric timer, however, and his mark is therefore not official.

MOTOR MOBILIZATION POSTPONED

CHICAGO, June 23—Plans of the Automobile Reserve Corps, Chicago Automobile Club division, to convey the First regiment, I. N. G., to Fort Sheridan by motor July 16, have been postponed. The call of the troops to the Mexican border has caused abandonment of the plans for the summer camp at Fort Sheridan.

K. C. TRACK ALMOST DONE

Kansas City, Mo., June 23—The new 1½-mile speedway south of Kansas City, being

built by the Kansas City Speedway and Exposition Co., will be finished by July 10 and the first event will be staged July 22. Several drivers have signed up for the races, including Ralph de Palma, Hudson Supersix; Eddie O'Donnell, Duesenberg; Eddie Rickenbacher, Peugeot; Ralph Mulford, Hudson Supersix; Earl Cooper, Burman Special; Jack Gabel, Sunbeam; Art Klein, Miles Special; and there is an entry of H. J. Rahe's Hudson with racing body, Mr. Rahe making the entry from the K. C. Automobile Training School.

The track is a triple radius track, built of the black gumbo that people of this territory know to be pasty and to pack like glue. There will be no holes dug in it by the tires. The track is 2,500 feet from a main rock road and is just on the edge

of Dodson. The Dodson city street car line runs to the grandstand. The tracks of three railroads, the Frisco, Missouri Pacific and Kansas City Southern, skirt the speedway.

GRAND RAPIDS GETS SANCTION

Grand Rapids, Mich., June 24—The A. A. A. contest board, through Chairman Kennerdell, having raised the ban on the local track for 1 day, it ordinarily being an outlaw track, the Automobile Business Association has promoted a 100-mile race for July 8 for cars under 450 cubic inch displacement. De Palma, Mulford and Anderson are expected. There will also be a 5-mile amateur free-for-all elimination race and an invitation Ford race.

State Highways Marked in Colors Massachusetts Through Routes Designated

BOSTON, Mass., June 24—Motorists touring through Massachusetts this year can follow their way very readily now by the marks on the poles and bridges along the way, the highway commission having about completed marking the various lines. The highway commission has adopted three colors. The red bands with borders of white at top and bottom are for the routes running east and west. Blue has been selected for the ones running north and south. Diagonal routes are marked with yellow. As the marks are very close together it is easy to follow a route by watching the poles even through the cities without the aid of a route book. Up to the present time there have been

plotted 11 blue, 5 red and 7 yellow routes. These are as follows:

BLUE ROUTES

Boston to Newburyport via Ipswich.
Boston to Haverhill via Reading.
Boston to Tyngsboro via Tewksbury.
Boston to Attleboro via Dedham.
Boston to Woods Hole via Brockton.
Worcester to Fitchburg via Sterling.
Springfield south via Longmeadow.
Springfield north via Northfield.
Pittsfield south via Stockbridge.
Pittsfield north via Dalton.

RED ROUTES

Boston to Williamstown via Fitchburg.
Boston to Hancock via Springfield.
Boston to Provincetown via Plymouth.
Seekonk to Wareham via Fall River.

YELLOW ROUTES

Salem to Andover via Danvers.
Littleton to Newburyport via Lowell.
Seekonk to Plymouth via Taunton.
Worcester to Blackstone via Northbridge.
Worcester to Athol via Rutland.
Fitchburg to Winchendon via Ashburnham.
Northampton to Pittsfield via Cummington.

French War Repair Shops Models of Systematism

Each Part of Derelicts from Fields of Battle Is Used in Building Up New Cars



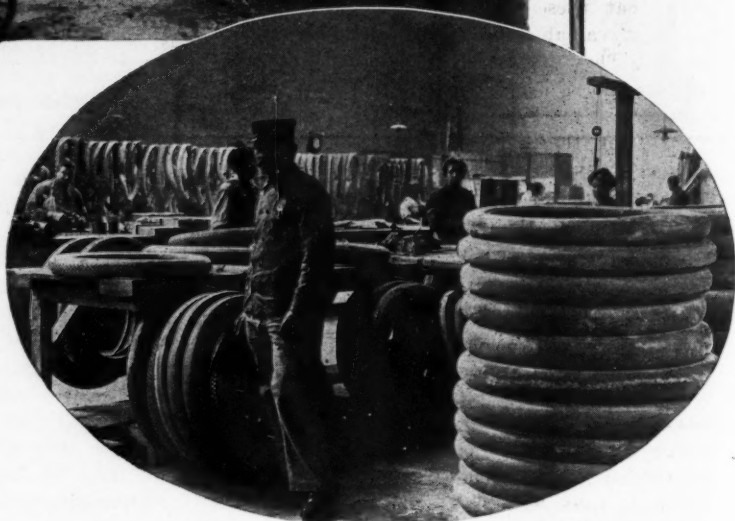
Some of the hundreds of motor cars wrecked in warfare, but they will all be returned to service in some form or other

By W. F. Bradley

PARIS—Special to Motor Age—"There must be a tremendous amount of motor car junk piling up behind the armies in France," stated the man who had followed the war from a distance. Doubtless this is a surmise shared by many who have reflected vaguely on the destructiveness of war, but have had no opportunity of examining the methods adopted to repair the inevitable wastage.

This opportunity to examine the methods adopted in order to prevent the wastage of motor car material and keep the mechanical transportation service of the army working on the most economical lines came with an invitation of the French War Department to visit its huge centralized repair depot. First aid in motor car breakdowns is given by the

No French chauffeur must throw away a tire. In this shop everything repairable is put back in service



traveling workshops attached to each convoy or group. More serious cases are dealt with by the general repairshop attached to the army and established only a few miles behind the lines.

The first-aid gang is only capable of dealing with a limited amount of work of a comparatively simple nature. Theoretically

the army workshop can tackle any kind of a job; but when these shops have to be established in barns, under canvas covers on some market place, when they are in danger of being shelled by the enemy, and when they are obliged to maintain a certain degree of mobility, they are apt to be submerged and incapable of carrying out the work entrusted to them either rapidly or economically.

Thus, back of the army workshops the French War Department has established its general clearing hospital. This unique establishment receives the whole of the overflow from the repair shops in the field. Cars and trucks which have been battered by shell fire, vehicles which can no longer be efficiently kept in repair, old models for which spare parts are not easily obtainable, the whole of the motor car wreckage of the battlefields, flows into this central establishment. This organization may be compared to the big hospitals which receive all the human wreckage of warfare. The motor car hospital, however, does not admit of a crematorium in the background, for under the wonderfully efficient system evolved by the French no vehicle, nor any wreckage of



The chisel and hammer gang working on a condemned orphan truck

a vehicle, can even be considered valueless.

Along the French front there may be some 80,000 motor cars of all kinds. This figure does not claim to be accurate, but it is sufficiently near the truth to give an impression of the vast organization dealt with. The overflow and the hopelessly incurables from this vast army are brought in by rail to the central repair depot at the rate of about 70 or 80 per week, and about 60 per cent of these are capable of being rebuilt into perfect cars fit for service in the fields.

When this organization was decided on the war had already been in progress a considerable period and there had accumulated several thousand battered remains of motor vehicles of all makes, from all countries, of all ages, having only one feature in common—their inability to run. The law of the survival of the fittest decreed that these first wrecks should be the least valuable of the automobiles of France. They comprised old models which had been doing useful if not very efficient work in various corners of France. When the net of the requisition agent swept them up they were thrown pell-mell into the army, and the army a few months later threw out their cracked and rusty bones.

The officers placed in charge of the central repair depot had to decide what should be done with this old-world wreckage and also with the more modern material which came in from day to day with only slightly varying regularity. It is an invariable rule in the French motor car service that no war-worn cars shall be thrown on the market and that not an ounce of metal nor a plank of wood shall pass into civilian hands. This rule has been strictly adhered to and will continue to be adhered to, to the disappointment of those bargain hunters who are hoping to secure war-worn vehicles for an old song and to the foiling of the man who habitually presides over the junk heap. Speculators can make no money out of



This may look like junk, but it is carefully kept under lock and key to go finally to the foundry to be molded into shells

this particular branch of the French army.

As each batch of wrecked vehicles comes in a group of expert officers examines them and decides whether the vehicle shall undergo repairs or whether it shall be dismembered. In the former case it is towed or carried away to the repair shops to be dealt with in a manner which will be described later. If dismemberment is in order, the vehicle goes into the temporary cemetery and is dealt with in proper order. These French officers have developed car dissection into a fine art; there is not an ounce of material on a car which is incapable of being used in some efficient manner. First of all the carburetor and magneto—if these two auxiliaries still remain—are taken off and sent to the stores. A special gang strips off the body, and while one man puts the horsehair into a sack another takes the cloth or the leather, another rips off the sheet metal panels and still another pounces on all the woodwork. The man who is interested in seat stuffings knows

the difference between horsehair and the many substitutes which pass under that general term—and he has a special sack for the real thing and another receptacle for the imitation. The same with upholstery and leathers. Real leather from a \$3,000 touring car is not stored with the imitation from a \$500 runabout. It takes no longer to classify them than to group them, and the saving on quantities is enormous.

The same system applies to the chassis. When the motor is taken out of the frame it is carried across to the cleaning shop. It may be found that this unit is in perfect condition, in which case it is cleaned and sent to the stores. It may be that the wreckage is so complete only one connecting rod can go into service again, in which case that single rod goes into the stores. The gearbox, the rear axle, the steering mechanism, the brakes, all pass under the same examination. If a gearbox, for instance, is unfit for further serv-

(Continued to page 36)



War-scarred motors, gearboxes and axles waiting to be cleaned and passed into the stores



Radiators which, after a little skillful treatment, will again enter the war

neath, and vaporization and distillation commence.

As the simplest explanation of what takes place during any distillation, let us consider what happens when a single chemical compound like water is distilled. When put into a closed vessel, and heated, water is changed into vapor (steam), which, if then passed through a cooled tube, is changed back or condensed into water. The operation of converting any substance into vapor by means of heating, and condensing it by lowering the temperature of the vapor, is called distillation.

Separation by Vaporization

Distillation as applied to hydro-carbon oil, is the separation of the more volatile portions from the less volatile portions by vaporization, and later condensing them by passing the hot vapors through a cooled tube. Light hydro-carbons like gasoline, vaporize very readily, whereas, heavy oils, form practically no vapors at atmospheric pressure and temperature, therefore, it is necessary to heat and boil crude petroleum in a closed vessel, in order to accomplish complete vaporization and separation of the different hydro-carbons. Since crude oil is a complex mixture of hydro-carbons, each of which has a different boiling point, a different temperature is required for the vaporization of each compound. Dissolved gas and the lightest hydro-carbons pass over first, and as the temperature is increased, heavier and heavier hydro-carbons are vaporized.

The vapors formed are led through a pipe from the still and discharged into the base of an aerial tower condenser. From there they pass up through alternate boxes and air-cooled tubes, where products of different boiling points are simultaneously condensed and thus automatically separated into groups. The lightest products pass completely through the tower and flow in vapor form to a water cooled condensing coil, where all light hydro-carbons condensable without the application of pressure, are liquefied and separated from the remaining vapors, which are further treated at a compressor plant, for the separation of very light hydro-carbons from the "fixed" gases.

Of the remaining vapors, the heaviest condense upon striking the first air-cooled tubes, and the lightest upon striking the last tubes. Intermediate products, lying between the light and heavy ends, condense in the intermediate tubes, depending upon their respective boiling point. The vapors liquefying in different sections of the aerial condenser fall back into corresponding collector pans, whence each is led by way of a separate water-cooled coil to the storage tanks, called "running tanks."

The liquids recovered in the collector pans are still at a temperature above their fire points, and it is necessary to cool them down to prevent spontaneous ignition, when they come into contact with air

in the running tanks. This process is dangerous and great care is exerted.

Distillation continues until a residue (crude cylinder stock), of about 15 per cent remains, when the fires are drawn and the remaining oil is pumped from the still through a cooler into a running tank.

The quantity and quality of products obtained from this first separation depend upon the method of distillation employed and from the base or family to which the crude petroleum belongs. This description, however, only concerns Pennsylvania crude oil of paraffin base. High quality oils are obtained when the separation is made by distilling under vacuum or by the use of fire in combination with steam injection. Due to the mixture of oil and water vapors in fire and steam distillation, oil vapors pass over at lower temperatures than were fire used alone. This prevents the occurrence of any serious cracking of the heavier products.

The prime object of subjecting the group-distillates from the running tanks of different processes is to further separate each group into the final market form of the many products obtained.

The secondary purpose of refining is to remove the impurities, color bearing, and unstable or unsaturated compounds and free carbon. It may be well to point out at this time that in the first group distillation there is no sharp line of demarcation between gasoline and illuminating oil or between any other similar fractions. Heavy constituents are mechanically carried over with the light portions and more volatile products are mixed with the heavy parts. In order to completely separate these, further distillation is necessary.

Naphtha Treated with Sulphuric

The crude naphtha distillate is pumped from the running tank to an agitator where it is treated with sulphuric acid, washed with water to remove the free acid and neutralized with caustic soda, again washed and separated from the water. The treated naphtha is next sent to a steam still where it is divided by distillation into various market grades of gasoline and pumped from there to the finished naphtha storage tanks.

The illuminating oil distillate is pumped to a steam still where the crude naphtha contained is separated by distillation and sent to the crude naphtha still. The illuminating oil remaining is sent to an agitator where it is acid treated, washed, neutralized, rewashed and filtered through Fuller's earth and pumped to the finished kerosene lamp oil storage tanks.

The crude light lubricating distillate passes from the running tank to a steam and fire still for the purpose of changing by heat the character of the paraffin wax from the amorphous condition to wax that may be crystallized and for separating the fuel oil content. The lubricating distillate then goes to a chilling tank where its temperature is lowered to such a degree as to cause crystallization of the wax. In this

chilled condition it is then pumped to a wax filter press, under high pressure, where it is separated into crude scale wax and pressed lubricating distillate. The pressed distillate then goes to a steam and fire still, where the gas oil is separated from it. The remaining distillate is then divided into lubricating oils of different viscosity, varying from very light to medium light, by fractional distillation.

The oils of different viscosities resulting from the fractional distillation are next sent to a Fuller's earth filter for the removal of color bearing compounds and free carbon. From the filter, these oils are pumped to the finished lubricating oil storage tanks.

Separate Scale Wax and Oil

The crude scale wax is sent from the wax filter press to a sweater, where it is separated into scale wax and oil. The scale wax then goes to a Fuller's earth filter, through which it passes to the finished paraffin wax tanks.

The crude heavy lubricating distillate follows the same course in processing as that indicated for the light distillate. Fuel oil and paraffin wax are separated in the same manner. The fractional distillation of the remaining oil results in lubricating oils of heavier body than those recovered by the processing of the light lubricating distillate.

Crude cylinder stock, being very viscous and difficult to handle, is greatly thinned down by mixing it with naphtha, and is then sent to a chilling tank where the amorphous (non-crystalline) paraffin wax, from which vaseline may be manufactured, settles out. This separation of paraffin wax from all grades of oil has the effect of lowering the cold test.

The oil-naphtha portion is separated and pumped to a Fuller's earth filter for the removal of color bearing compounds and free carbon. From the filter it passes on to a steam still where it is separated into naphtha and low cold test cylinder stock. From the still the oil is sent to a tank where it is blown with air to remove traces of moisture. After this air drying process, the cylinder stock is pumped to the finished storage tanks.

Oils manufactured from the lubricating distillates of paraffin base, crude petroleum, are usually not heavy enough for heavy and extra heavy grades. It is therefore necessary to blend these filtered "straight run" lubricating oils with highly filtered low cold test cylinder stock of extremely heavy body to produce oils of heavy and extra heavy body required in some types of internal combustion engines.

ORDER IN FUEL PUMP CASE

Chicago, June 26—Judge Carpenter, presided over an order in the case of F. Bowser & Co., Inc., against the Wayne Oil Tank & Pump Co., for infringement of their patent on a dispensing apparatus issued August 25, 1914.

New Combination of Car Parts Makers

Steel Products Co. Heads 4,000,000 Merger of Motor Metal Plants

DETROIT, June 26—In order to effect the usual economies of large-scale production and with a view to considerably broadening the service offered the car builder, interests headed by C. E. Thompson, president of the Steel Products Co., Cleveland, O., have obtained control of several large plants specializing in manufacturing and engineering work for the motor vehicle makers. With a capital of \$4,000,000, the interests that are to be consolidated under the name of the Steel Products Co., with headquarters at Cleveland, are: the present Steel Products Co., Cleveland; the Michigan Electric Welding Co., Detroit; and the Metals Welding Co., Cleveland.

The officers of the new Steel Products Co. are C. E. Thompson, president; W. D. Bartlett, vice-president; and J. A. Krider, secretary and treasurer. The plants will continue to operate under their own names as subsidiary plants of the Steel Products Co., and the consolidation will undoubtedly be developed along the same lines as the Steel Products Co. E. C. Reader, manager of the Metals Welding Co., and C. F. Clark, manager of the Michigan Electric Welding Co., will continue in their present capacities.

The Steel Products Co. makes valves, spring bolts, and other hardened and ground parts; the Michigan Electric Welding Co. produces drag-links, brakes, torsion radius rods and other rod assemblies, headlamp brackets and spring clips; and the Metals Welding Co. makes acetylene welding equipment, high-speed cutting tools, and does a large business in motor-vehicle welding work. Each firm is a leader in its particular line, having for some years furnished parts for nearly all the leading car makers. The equipment owned by the new combine covers some of the most important processes in motor car manufacture, such as metallurgical work, heat treating, precision grinding, polishing, electric welding, acetylene welding, and automatic machine and general steel manufacturing equipment. Extensive additions to all the plants affected are now under way.

TUBING MAKERS TO BUILD

Detroit, June 24—The Detroit Seamless Steel Tubes Co., maker of a wide variety of tubing for motor vehicles, has purchased a 12-acre site in the western part of the city for the purpose of erecting a new factory that will allow four times the present output. It is estimated that the plant, which will be entirely under one roof, will have a length of 700 feet and a width of about 400 feet, enabling an output of 5,000 tons monthly with a payroll of 1,000 men. In this business the furnaces must be kept

going continuously, making necessary working 24 hours of the day.

The Detroit Seamless Tubes concern is now turning out about 300 tons of tubing monthly with a force between 300 and 400 men, about 80 per cent of the product going to the motor car industry and the balance being used in locomotive boiler construction. Rear axle tubes, and a great variety of sizes and shapes of tubing for the needs of the modern car have revolutionized the tube business. This company started in 1900 with a 100-ton monthly capacity and 100 men, an indication of the rapid strides that have been made. Prominent Detroit business men are connected with the enterprise.

WALTER MARMON INJURED

New York City, June 26—Walter Marmon, president of the Nordyke & Marmon Co., Indianapolis, Ind., is fast recovering from a painful injury received in an accident in this city on June 17 when his car struck an L pillar. Franklin Hall, a retired business man of Philadelphia and father-in-law of Mr. Marmon, died in the Polyclinic hospital from injuries received in the accident. Mrs. Marmon escaped with slight bruises.

GARFORD ADDS \$2,500,000 TO STOCK

Lima, Ohio, June 20—The capital stock of the Garford Motor Truck Co., this city, has been increased from \$2,500,000 to \$5,000,000. The common stock is increased from \$1,250,000 to \$2,500,000 and the preferred on the same basis.

The increase was made to take care of the enlarged business. Preparations are being made for a 40 per cent increase in the capacity of the plant.

FORM NEW ELECTRIC COMPANY

New York, June 26—A. F. Wagner, president of the Wagner Specialties Co., New York, and Frank Hoyt, formerly chief engineer of the Simms Magneto Co., together with Gerald Laugh, formerly connected with the National Cash Register and Burroughs Adding Machine companies, have formed the Wagner-Hoyt Electric Co. and will manufacture complete electrical equipment for motor cars. Wagner will be president and general manager of the company, Hoyt treasurer and chief engineer, and Laugh, secretary. A factory somewhere in New Jersey will be occupied, though the exact location has not been decided.

The concern has obtained a license under the patents of the late H. Ward Leonard covering the control of electric lighting systems on motor cars and in addition

to producing the complete electrical equipment of a car including starting and lighting, ignition and lamps, will also market a new type of storage battery. The concern will market its product as a complete unit for the entire electrical equipment of a motor car.

NEW FACTORY FOR FLINT

Detroit, June 20—The L. A. Young Corp., a holding company which owns the Detroit Wire Spring Co., and several other large automobile parts plants here, has purchased a 7-acre tract of land at Flint, Mich., on which will be erected a very large parts plants here, has purchased a 7-acre tract of land at Flint, Mich., on which will be erected a very large plant to be known as the Flint Cushion Spring Co. L. A. Young of this city is president, and C. O. Ormsbee, for 17 years with the Durant-Dort Carriage Co. and 11 years in the trimming end of the Buick organization, has been made factory manager. Eventually some seven units will be erected on the Flint site, according to Mr. Young, the first of these being under construction at the present time. Besides cushion springs, other small parts for cars will be made at Flint. The Detroit spring factory, now making 500,000 sets of springs annually, is being enlarged also by a building 400 by 100 feet.

TO BUILD ENGINES

Saginaw, Mich., June 24—A concern to manufacture motor car engines has been incorporated here by the name of the Wilcox Motor & Mfg. Co., with a capital stock of \$150,000, all of which is said to be subscribed for. The organizers are Rollin H. White of Cleveland, O., and M. L. and M. M. Wilcox of this city. While it is yet too early to state just what the plans and policy of the new organization are, it is believed the concern will at once get ready to enter the motor-making end of the industry here.

PAIGE-DETROIT EARNINGS BIG

New York City, June 26—The Paige-Detroit Motor Car Co., Detroit, is earning at the rate of \$1,500,000 per annum, which compares with actual earnings in 1915 of \$654,000 and in 1914 of \$123,000. With the recent 80 per cent stock dividend and the additional \$100,000 stock sold, there is now outstanding \$1,000,000 capital stock, par value \$10. Earnings this year are at a rate equivalent to 150 per cent on the stock.

The net tangible assets of the company as of June 1, with the full \$1,000,000 stock outstanding, were \$1,504,497, or \$15 per \$10 share.

HUMPHRIES OUT OF CHALMERS

Detroit, June 26—S. H. Humphrey, vice-president in charge of manufacturing of the Chalmers Motor Co., has resigned to take up similar duties with the Briscoe Motor Corp., Jackson, Mich. The Chal-

mers company has not yet appointed a successor.

Mr. Humphrey joined the Chalmers forces in April of last year, coming from the Hupp Motor Car Co., with which concern he had been connected for 2½ years. He has had a long and varied experience in his field of the industry. On first entering the Chalmers organization, he was works manager, being elected a vice-president during the early part of May of last year.

SCHEBLER CHANGES NAME

Indianapolis, Ind., June 26—The firm name of Wheeler & Schebler, carbureter manufacturers, will be changed July 1 to the Wheeler-Schebler Carbureter Co., Inc. There will be no change in the policy or personnel of the organization.

PROTEST DIXIE USE OF FLAG

Moline, Ill., June 23.—A resolution against alleged misuse of the Stars and Stripes, as contemplated by builders of the Dixie highway, was adopted by the Moline, Ill., grand army post. It is charged that the promoters plan to place United States and Confederate flags at intervals along the road, the purpose of which was to signify the complete reunion of the North and the South.

NEW COMPANY FOR TOLEDO

Toledo, Ohio, June 23.—The Wolverine Automobile Co., capitalized at \$175,000, will establish a plant in Toledo, O., where it will manufacture a four-cylinder car. Manufacturing will be started about July 1.

The president and general manager is A. H. Collins of Detroit; secretary, E. W. K. Burg, Toledo; and treasurer, H. E. King, Toledo. The Old Com-pakt furniture building on Dorr street with 9 acres of ground, will be used for manufacturing. About 1,000 cars will be made the first year. The company will make cars ranging in price from \$1,500 to \$2,500 in two, three and four-passenger roadster models, a four-passenger touring model, four-passenger sedan and a two-passenger coupe.

GORDON TO MAKE TIRES

Columbus, Ohio, June 26—Manufacture of tires will be undertaken by the J. P. Gordon Co. just as soon as machinery can be installed. Owing to the rush in the factory where the machinery is made Mr. Gordon said that he did not think it would be possible to start this new department before 4 months. A tire expert has been employed and the preparation of the room and the installation of the machinery will be under his direction.

The company was started 16 years ago and formerly was known as the Vehicle Hood and Apron Co. It makes tire covers and a variety of accessories, including a one-man top. Two new buildings in the factory group just have been completed. The company has disposed of its raincoat and clothing business.

Two Demountable Rim Patents Granted Parker of Hydraulic Pressed Steel Wheel Awarded Rights on Design Believed Not to Infringe Perlman

NEW YORK, June 27—Special telegram
N—Two new demountable rim constructions which are claimed to avoid the Perlman patent have been granted protection by the U. S. patent office on the application of O. A. Parker, manager of the wheel department of the Hydraulic Pressed Steel Co., Cleveland, O.

The company states that it assumes from the granting of the patents that the essential feature of the Perlman patent is the use of a single nut or similar device which operates a wedge holding the rim both laterally and radially. In the new patents the rim is secured radially by one set of attachments and laterally by another. Further, it is claimed that these individual attachments are of great value in that they prevent the rim from being misplaced.

No Wedge Action

Since neither the radial nor the lateral attachments have a wedging action and simply exert straight pressure, it is possible to tighten one completely before passing on to the next. There is no need to tighten the various securing nuts progressively.

The wood wheel has a felloe band with a flange which is not coned but merely stands square to the wheel. On one side of the demountable rim there are some dowel pins which take the drive. Opposite the dowel pins several bolts or set screws are threaded radially through the felloe. Close to these radial bolts are two or three transverse bolts by means of which small tongues of steel are drawn against the outer edge of the detachable rim so pressing it laterally against the flange at the back of the felloe band.

To attach the rim, the dowel pins are hooked into the holes provided for them and the rim then pushed on the wheel. The lateral clips can then be tightened, pressing the rim back against the shoulder on the felloe band and a few turns of

the radial bolt will then complete the locking.

The steel wheel operates on much the same principle and is based upon the already well-known Parker steel wheel. In this case, there is no felloe band, the rim attaching from the ends of the spokes. These spokes are provided alternately with radial locking bolts and lateral clips. It is claimed that the new rims are lighter than the majority of demountable patterns and that it has a production advantage as no hot-rolled parts are required, the rims being rolled up from ordinary sheet. It is announced by the Hydraulic Pressed Steel Co. that it will be in a position to commence deliveries on a large scale almost immediately.

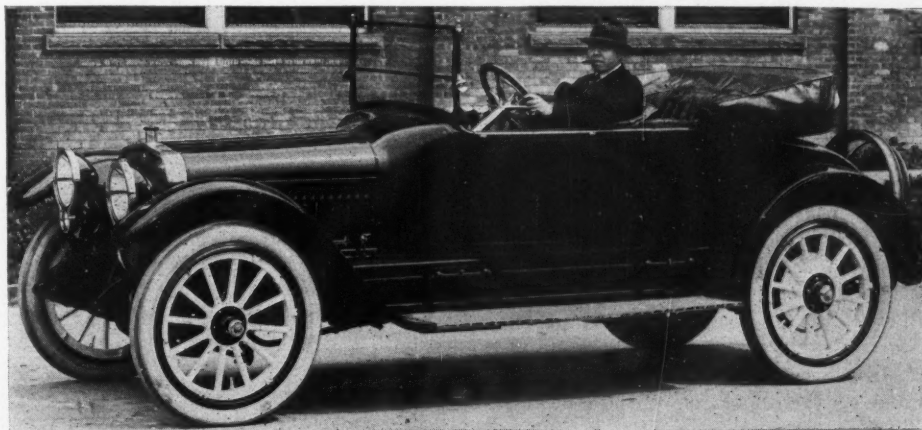
The wood wheel rim patent is No. 1,188,200, on which application was filed April 1, and the steel wheel rim patent is No. 1,188,353, application for which was made May 5. Both patents were granted June 20.

ELGIN BUYS NEW ERA

Chicago, June 24.—The New Era Engineering Co., Joliet, Ill., which produces the New Era car, has been taken over by the Elgin Motor Car Corp. of Chicago. F. J. Alvin retires as president and general manager and has been succeeded by W. J. Burdick. The new owners are considering a proposition to remove elsewhere and consolidate the plant with the Elgin plant.

CHRYSLER STAYS WITH BUICK

Flint, Mich., June 25—Walter P. Chrysler is not to leave the General Motors organization. He has been advanced from the position of factory manager of the Buick Motor Co. to general manager, filling the vacancy occasioned by the resignation of President C. W. Nash, of General Motors, who was also president and general manager of Buick.



New Winton four-passenger runabout

Pathfinders on Jackson Highway Encounter Fine Roads



Many such nooks as these are found along the Jackson highway

Residents
Along Road
Display En-
thusiasm Over
New Project



Stretch of road in Jackson county, Ind.



View of one of the parks visible from the road along the Jackson highway

LOUISVILLE Ky., June 25—Pathfinders for the Jackson highway through Indiana and the Bluegrass section of Kentucky have had their hopes more than borne out, and after 5 days of speechmaking through the fairest sections of the Hoosier and Bluegrass states, all are fully convinced that for a road as young as the Jackson highway, there is none superior for so great a distance. At the present time the road is marked all the way from Chicago to Nashville and with the exception of about 5 miles in Union township, Lake county, just north of Rensselaer, better roads to Indianapolis could not be asked for consistently, and south of the Hoosier metropolis one finds good roads all the way to the Kentucky line except a few miles just north of New Albany, where improvements are about to be made and several grade crossings eliminated. At that, both the stretch north of Rensselaer and that north of New Albany are such that 15 to 18 miles per hour can be made easily.

The cavalcade left Chicago June 20 at 10 o'clock, a delegation from Hammond driving into Chicago to take the inspection party through Lake county to Crown Point. At that point members of the chamber of commerce and others escorted the party to the Kankakee bottoms, where the Rensselaer delegation headed by the mayor and other city and county officials met and escorted the tourists to the county seat of Jasper county. They were none too proud of their bad road in Union township and they now have the money and plans ready for repairing this few miles—

the only road that could be called bad between Chicago and Indianapolis on the Jackson highway.

Even after a heavy rain of all night scarcely any mud or water was encountered the next morning on the leg to Lafayette, which speaks well for the drainage and crowning of the highway. The chamber of commerce of Lafayette, a very aggressive organization, met and entertained the inspectors, showing them the city and having a meeting at which several men from Purdue University took part as well as Peter Lee Atherton, president of the Highway, Joseph H. Leopold, secretary of the Frankfort, Ky., chamber of commerce; Walter R. Crim, Salem, Ind., one of the original pathfinders for the Jackson highway and an Indiana official; J. H. Creveling, Nashville, Tenn., vice-president of the highway; Emory G. Dent, Bowling Green, Ky., vice-president of the highway for Kentucky; Judge Durham, Gallatin, Tenn., and others, all members of the party making the tour.

Let it be understood that this is strictly a relay tour, none of the cars going all the way through. I changed cars sixteen times

between Chicago and Louisville and, believe me, those Indiana fellows have some cars. I rode in a different car every change, that is a different make, and they were some of the best cars on the market, too.

In the afternoon, Lafayette reluctantly let the party go, after escorting it to Frankfort, a city that is unique in many ways. It has but 10,000 population, but it has 152 miles of paved streets and in all the traveling about through its fine residence district, where everything showed the touch of pride that makes one keep things painted and cleaned up. This little city can boast of the fact that 75 per cent of its people own their homes, yet there isn't a millionaire in the town. Another thing that is really remarkable for a town of its size is that it has an 80-acre park on its outskirts which is visited by hundreds of motorists every Sunday and many on week-days.

When we were more than 15 miles from Frankfort we began to see the spirit of the people along the road, for every farmhouse was decorated with flags, families were on the porches and as we came nearer the city we found the crowds thickening and a big number of cars were escorting us. At every opportunity where one of the telephone poles with the "J. H." on a band of white came in front of a farmhouse, two flags were crossed over the insignia of the Jackson highway.

The next stop was a short one at Lebanon, Ind., after which Indianapolis was reached about 7 o'clock in the evening. Later a meeting was held in the Chamber of Commerce under the joint auspices of

By William K. Gibbs



Frankfort, Ind., near the 80-acre T. P. A. park

the chamber and the Hoosier Motor Club. Charles A. Bookwalter, former mayor of Indianapolis, was a guest and one of the speakers. He described the conditions of the roads leading immediately out from Indianapolis, and said they did not compare favorably with those that they joined in surrounding counties. Peter Lee Ather-ton, president of the highway association, told of what he hoped to make of the Jackson highway, and Smith R. Graves, told what the farmer wants in the way of roads.

Escorted by members of the Hoosier Motor Club the caravan got away from Indianapolis Thursday morning with Louisville the objective for the night. Greenwood was the first change, these cars taking us to Columbus and others joining in so that by the time Seymour was reached we had quite a following of cars. At Seymour the party was entertained by the commercial organization and the first stop of the afternoon was at Salem, Ind. A band and several cars were found on the outskirts of the city to greet us and after a parade through flag-bedecked streets, full of cheering hundreds, a stop was made at the county court house and Dr. Ben L. Bruner, Louisville, Ky., former secretary of state, told a crowded courtyard what Indiana needs in the way of a state highway commission, in order that it may obtain more than \$2,000,000 a year, its share of federal aid that would come to it were there an organized state body to administer it.

Mr. Dent was the other speaker of the afternoon. After leaving Salem no stops were made on the way to Louisville. Delegations from the Louisville Automobile Club acted as pilots on the last leg of the journey to Louisville.

Road Inquiries Answered

Anadarko, Okla.-Chicago

Anadarko, Okla.—Editor Motor Age—Kindly give the best route from Anadarko, Okla., to Chicago, Ill., via Kansas City, St. Louis.—Hammert & Ayres.

On your trip to Chicago, going through Kansas City and St. Louis, you will find the following to be your best routing:

Go through Chickasha, El Reno, Kingfisher, Hennessey, Enid, Pondcreek, Medford, Caldwell, Wellington, Wichita, Newton, Florence, Elmdale, Cottonwood Falls, Plymouth, Emporia, Waverly, Williamsburg, Ottawa, Wells-ville, Gardner, Olathe, Overland Park, Kansas City, Independence, Levasy, Wellington,

Lexington, Dover, Grand Pass, Marshall, Boonville, New Franklin, Columbia, Fulton, Williamsburg, Mineola, Danville, Jonesburg, Warrenton, Wentzville, St. Charles, St. Louis.

Next drive north through Collinsville, Edwardsville, Staunton, Litchfield, Springfield, Lincoln, Bloomington, Lexington, Pontiac, Dwight, Morris, and Joliet, into Chicago.

Volume 5 of the Automobile Blue Book will give you complete routing for this trip.

Santa Fe, N. M.-Chicago

Cortez, Colo.—Editor Motor Age—We are contemplating making a trip from Santa Fe to Chicago and would like to know where we may procure a reliable road guide.—E. R. Mullen.

For your trip Santa Fe to Chicago we recommend that you procure Volume 5 of the

Automobile Book. This will give you the complete routing from Santa Fe to Chicago and is the most accurate road guide for this trip that you can procure. The price of same is \$2.50, and can be procured through the Automobile Blue Book Publishing Co., Mallers Bldg., Chicago, Ill.

Cheyenne, Wyo.-Yellowstone Park

Bridgeport, Neb.—Editor Motor Age—Kindly give the best route from Cheyenne, Wyo., to Yellowstone National Park.—Frank Brown.

In going from Cheyenne, Wyo., to Yellowstone Park, the best routing is to go up through Wheatland, Badger, Douglas, Glenrock, Casper, Lost Cabin, Thermopolis, Basin, Cody, then from here you go straight west into the Park.

Volume 5 of the Automobile Blue Book will give you complete routing for this trip.



Jackson highway passes through the rich farming country of Indiana



An old stone mansion along the Jackson highway

Overland Announces New Model 75-B

Maxwell's Price Reduced \$60—Other Makers
Continue Without Change

TOLEDO, June 24—Announcement has just been made of a new series of the smaller four-cylinder Overland that was originally brought out last November as model 75. The new car is known as model 75B, and is very little different from the previous series except in the increase of the bore from $3\frac{1}{4}$ inches to $3\frac{3}{4}$ inches, with the stroke remaining at 5 inches. There are other engineering refinements of a minor character that add to the efficiency, however. The price of the new 75B touring car of five-passenger capacity is \$635, and the roadster costs \$620. The previous series touring model was \$615 and the roadster \$595, and while the greater materials cost would be sufficient reason for a price increase of this amount, the increase of the engine power together with the other refinements that have been made, render the car well worth the additional figure even though the materials markets had not skyrocketed.

There have been no alterations to speak of in design in the power plant except those changes that have added to the power. The motor now develops 31.5 horsepower at 1,950 revolutions per minute. The body looks practically the same, and there are the same little conveniences such as the electrical control box on the steering column, one-man top, demountable rims, and all the fittings of the day.

This model Overland is built on a wheelbase of 104 inches, has cantilever rear springs, retains the characteristic Overland construction of incorporating the gearset with the rear axle, possesses the tapered frame, is fitted with Auto-Lite starting and lighting, and has 31 by 4 tires.

ALLEN CONTINUES SAME MODEL

Fostoria, O., June 28—The Allen Motor Co. announces that its present model 37 touring car and roadster will be continued without change for the 1917 selling season. The price of \$795 for touring car and roadster is given in the announcement of the continuation of this model but, while the company states that the car will not be changed, it does not guarantee that there will be no raise in price.

For those who are possibly not acquainted with Allen construction, it is a four-cylinder car with 112-inch wheelbase, floating rear axle, 55-inch underslung rear springs, and such refinements as a two-unit starting and lighting system, Stewart vacuum gasoline feed from a tank in the rear, Firestone demountable rims and non-skid tires in the rear.

The Allen company has recently brought out a two-passenger roadster for this chassis that is unusually attractive. The body,

which is of streamline design, is carefully proportioned and deep cushions assist in making riding a pleasure. It is fitted with a big and accessible rear deck compartment, the door to which opens wide and is waterproof. It is finished in olive green as are the wheels, while the radiator, hood, fenders and running gear are black enamel.

All instruments are mounted on an instrument board in the cowl dash and include electric switches, ammeter, speedometer and carburetor adjusting knob. The horn button is conveniently located on the top of the steering column directly over the control levers.

LARGER ARGO MODEL PLANNED

Jackson, Mich., June 24—A larger four-cylinder model is to be marketed by the Argo Motor Co., this city, as a running mate to the present four-cylinder car. Details of the new model are expected in 30 days.

MAXWELL LOWERS PRICES

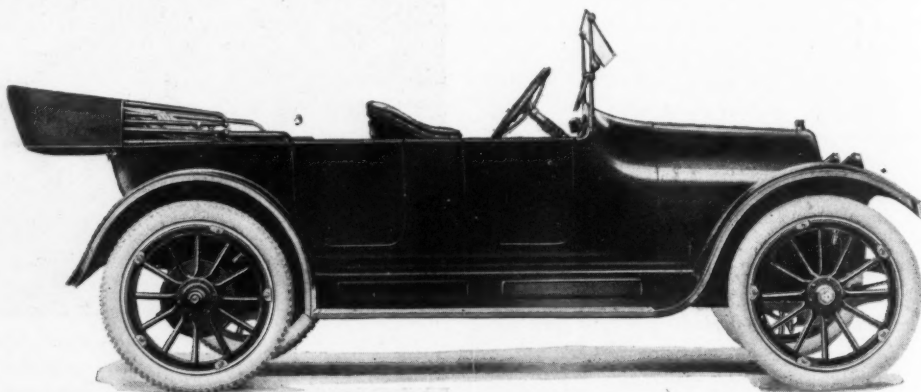
Detroit, Mich., June 27—Special telegram—Effective July 1, the Maxwell Motor Co. will market its touring car at \$595, a reduction of \$60, and will sell the road-

ster at \$580, a drop of \$55. Coming at a time when nearly every other manufacturer has either raised his prices or is thinking of doing so, the Maxwell company's move is a distinct surprise to the industry and is ascribed to a greatly increased production that offsets any increases in the cost of materials. The schedule now calls for an output of 100,000 cars for the coming selling year.

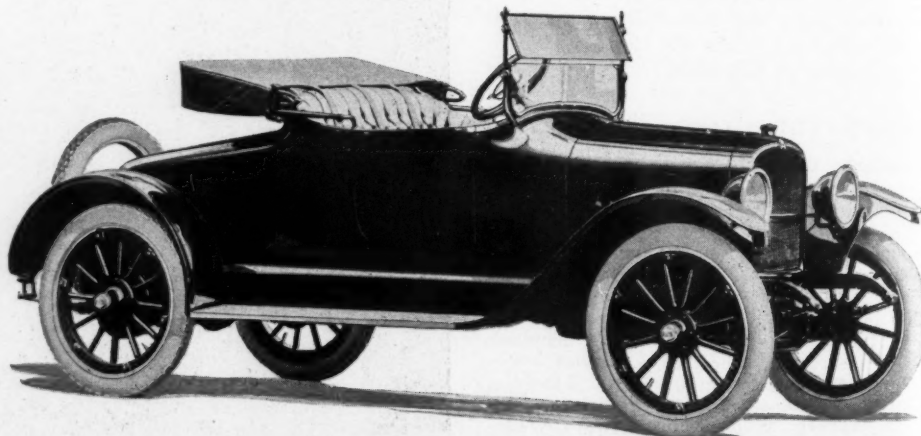
The 1917 Maxwell is not changed over the present car. The Maxwell management now believes the car to be standardized and will not alter the product in any way. The regular chassis of 102 inches wheelbase and powered with a $3\frac{3}{4}$ by $4\frac{1}{2}$ four-cylinder block motor is continued, carrying the same five body types, namely: touring car, roadster, cabriolet, town-car and sedan.

EMPIRE TO ANNOUNCE LATER

Indianapolis, Ind., June 27—According to an announcement just made by the Empire Automobile Co., of this city, no change from present models is contemplated before about the time of the New York show next January. This is in accordance with the practice which Empire adopted last year.



Overland model 75B, upon which the price has been increased \$25

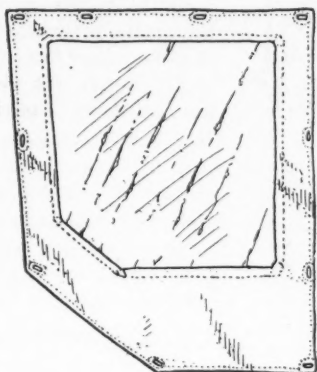


Allen's new roadster body fitted to chassis which is being continued for 1917

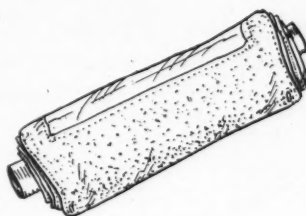
The Motor Car Repair Shop

Things Which Ruin Curtains and How to Avoid Them

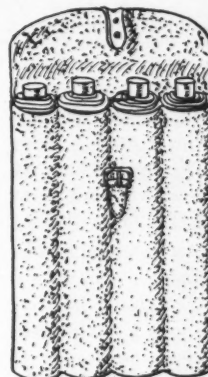
Proper
Method to
Clean
Mica



Result of improperly folded curtains



Curtain rolled around mailing tube



Inexpensive carrying case

Carrying
Case to
Protect
Windows

THERE is many a motorist who does not hesitate to condemn the treatment his car receives at some certain garage. If that same motorist, who belittles the efficiency of a repair man were to look into his own tool boxes and baggage compartments, and if it were human nature for a man to give an entirely unbiased opinion of himself, he might agree that his own carelessness was costing him more money and inconvenience than the garageman's neglect.

Particularly is this true of the care of side-curtains. These particular items are one part of the car which are brought into use quickly and are stored away in equal haste. When the rain comes the owner yanks his curtains from the baggage compartment in which they are stored and applies them. Then, when the sun comes out again, he pulls them off with equal haste, and loads them at random into the nearest available space.

The result is that the curtains become covered with dust and dirt and the mica windows become cracked and broken so that the assembly is eventually so unsightly that the owner is ashamed to put it on his car, preferring to ride in the wet and cold. Such a thing is totally unnecessary. It is as easy to care for the side-curtains properly as it is to keep the spark plugs clean, easier in fact, because it does not require any mechanical knowledge. And a set of new side curtains is more costly than a set of spark plugs.

Suppose your car is equipped with six curtains, three on a side. It would cost you about \$1 to have two sacks made up, such as are shown in the illustration above, in which these curtains could be properly stored, free from dust and dirt, and not liable to shuffle about among an assortment of tools, tire chains and the like, which is their location in about nine out of ten cases. Most baggage compartments

are dust catchers and loose curtains will suffer.

These sacks should be made about 20 inches wide and long enough so that, when the curtain is rolled up it will just fit into the sack, so that the top of the rolled curtain is even with the top of the opening. Procure six paste-board mailing tubes of the proper lengths and roll the curtains around these tubes.

It is never advisable to fold the curtains flat, as it will be practically impossible to crease them so that the mica windows will not be folded over at the creases, and it is this folding of the mica which cracks and breaks it. If the curtains are rolled about something such as the mailing tubes, this danger will be eliminated.

Three curtains, rolled up as described above, should fit very compactly into a leather case of the dimensions previously given. This case can then be stored away in any convenient location in the car without danger of damage to the curtains contained inside.

Mica Windows Cracked

For the owner who reads this article, and decides to take the advice given, only finding upon examination that his curtains are already in bad condition, it may be said that curtains which are covered with oil and filth, providing they are not torn and the mica windows cracked, can be brought back into fair condition by a thorough scouring with Ivory soap. It will not harm the leather, or rather the imitation leather, as the latter material is universally used, to scour it.

If the mica is cracked and the curtains are torn about the fastenings, it would be the best plan to procure a new set of curtains and then set about to provide for them in a suitable manner so that there will be no need of going to that expense again. A set of curtains, properly cared

for, should outlast the car itself.

It is a regrettable fact that many of the car manufacturers, especially the low-priced car makers, utilize such things as the side-curtains and other equipment to reduce the cost of the assembly. Probably they consider that curtains are not used enough to need any special attention as regards design to make them sturdy and dependable. The result is that many owners, when driving their cars in a wind storm, suddenly find one or more of the curtain fastenings pulling out from its moorings, leaving a tear in the curtain material, and rendering it practically useless.

It is better to make the necessary alterations in the curtains to prevent this than to wait until it occurs. In many curtains there is an excuse for a reinforcement patch sewed into the curtain material around the fastener, which is generally about as valuable as no patch at all. The owner who wants his curtains to be permanent should take them to a harness maker and there have genuine leather reinforcing patches sewed around all of the fasteners. With this done there will be no danger of torn curtains, and if the patches are neatly sewed onto the inside of the curtain, they will not be unsightly.

The proper care of side curtains is a good subject for the garage man to preach to the owner who patronizes him, and side curtain cases carried in the accessories stock would undoubtedly net a good profit. When an owner drives his car into the garage for the night and, his curtains being up, requests the garage man to take them down, it is the opportunity of the garage man to suggest to that owner in the morning that he procure proper provision to care for his curtains. The garage owner who enjoys increasing popularity is the one who suggests things to the owner that will save him money.

The Readers' Clearing House

SCHEMATIC WIRING OF OWEN CAR

Explanation and Diagrams Showing Operation of Magnetic Speed Change

ELMHURST, N. Y.—Editor Motor Age—Kindly show the schematic wiring of the Owen Magnetic car.—A. S. Kingman.

The connections are shown in Fig. 7. It will be noticed that the motor on this position has a shunt field, opposed by a series field in the battery circuit, making it a differential generator with an inherent self-regulating characteristic. On all other power control positions, but the high, the motor helps turn the propeller shaft, by taking current from the clutch generator in whose circuit it is included. At these times the slip in the clutch generator is greater than needed to energize it as a clutch, and the additional slip produces the current required for the motor, which it utilizes for giving additional turning effort to the propeller shaft.

Figures 4 to 6 illustrate the connection for these positions. The different gradation of speed and torque are controlled by the relative strength of the generator and motor fields. The weaker the generator field compared to the motor field the greater the slip and the more electrical energy goes to the motor for producing greater torque.

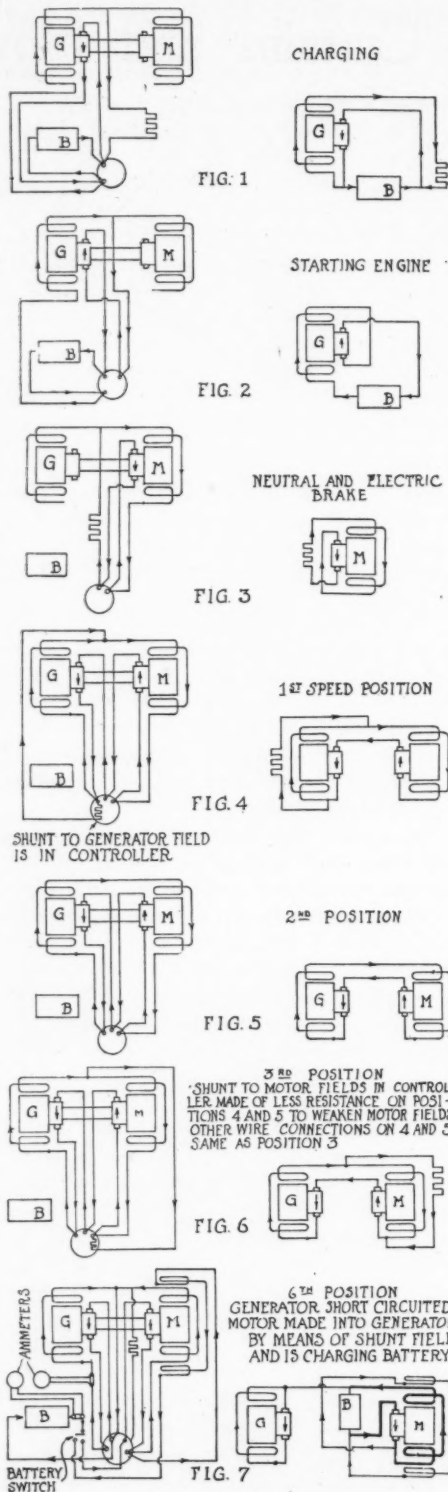
Fig. 4, showing the first power control position, shows the generator field shunted so as to weaken it, while the motor field is full strength, being unshunted.

Fig. 5 shows both fields unshunted, but the motor field is still the stronger, due to its being wound with more turns.

Fig. 6 shows the generator field unshunted, but the motor field shunted, by means of which it is weakened as compared with the generator field, in which case it gives less torque for a given current, but also less counter electro motive force, and therefore less slips at the generator.

There are from three to four positions of shunted motor field in different amounts, each step bringing it closer to the high speed position, where both armature and field of the motor are cut out of the generator circuit, and the generator acts as a clutch only, as previously shown in Fig. 7.

Besides the positions of power control, there is a neutral position, where the clutching effect is cut out, but the motor is so connected through a resistance as to act as an electric brake, in which case it becomes a generator, taking power to drive it, and so braking the car. This brake is most effective when the speed is the highest, and is ineffective below fifteen miles per hour; it will hold the car on any mountain grade to 20 miles per hour without wear of any parts, and can be applied with



Schematic wiring of Owen magnetic car

the car going 60 miles per hour. It cannot hold the wheels and there is little danger of skidding, as the braking effort disappears at speeds below 15 miles per hour.

Fig. 2 shows the clutch generator being used as an engine starter; in this case, the field and armature connections are re-

versed so as to turn the engine forward, and the starting battery is included in its circuit.

Fig. 1 shows another way of charging the battery; while the car is standing, this is done from the generator and a much higher rate of charge is possible than would be safe to establish for running conditions. So that if, for any reason, the battery should be run down, it can be brought up in a short time, as a high rate of charge is permissible for a battery that has not reached the gassing point and is not warm.

VALVE-IN-HEAD MOTORED CARS

Overhead Camshaft Should Not Make a Noisy Engine

Garrettsville, O.—Editor Motor Age—Kindly give the names of the most prominent car manufacturers using valve-in-the-head motors. 2—If this construction is the most powerful and most efficient, why has it not proven more popular especially since power and fuel economy are what manufacturers are striving for?

3—Can the valve-in-the-head, overhead camshaft arrangement be made to run as quietly as the usual L-head style?

4—I understand that a valve-in-the-head motor is approximately 25 per cent more powerful than an L-head motor of the same general dimensions. Is this true for ordinary speeds or only for maximum speed and power?

5—How do you account for this extra power from the valve-in-the-head type?—Paul Love.

1—Buick, Briscoe, Chalmers, Chevrolet, Dorris, Enger, Franklin, Grant, Inter-State, Marmon, Oakland, Oldsmobile, Pathfinder, Scripps-Booth.

2—It has proven popular and is proving more so each year.

3—It can if properly enclosed and if the valves are kept properly adjusted.

4—Fifteen per cent is a conservative estimate of the increase in power of a valve-in-the-head motor over a side-valve motor of the same dimensions. This holds good for all running speeds.

5—More efficient intake and more complete exhaust of the gases, due to the location of the ports.

Maximum Speeds and Powers

Trenton, S. C.—Editor Motor Age—What is the most power developed by the Chalmers 6-30? By the Buick light six?

2—What is the maximum speed of the Chalmers 6-30? Of the Buick light six?

3—What is the best record ever made by a Buick in gasoline consumption? By a Chalmers?

4—Which has the world's record for speed, motor car, motorcycle, an aircraft or electric car, and what is it?

5—Is it true that all 1917 cars will have 56-inch tread?—Wright Moore.

1—About 45 horsepower in both cases.

2—The maximum speed of these cars is somewhere around 60 miles per hour.

3—We have no data on these points. You could undoubtedly get it by writing the factories.

4—Motor car. Duray in Fiat. 142 miles per hour, unofficial.

5—Practically all. The National Auto-

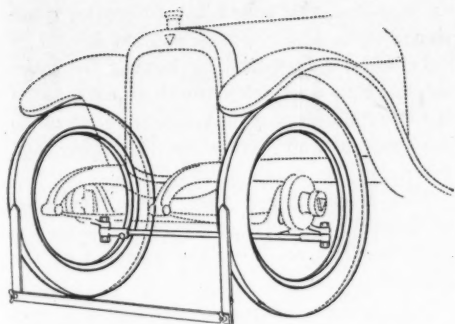


Fig. 8—Method of lining up Hudson wheels

mobile Chamber of Commerce was instrumental in bringing about standardization in this particular. Practically all makers, however, offer the 60-inch tread as special equipment for use on southern roads.

THE WAY TO LINE HUDSON WHEELS

Diagram and Explanation Showing How to Make Proper Setting

La Salle, Ill.—Editor Motor Age—Kindly give the proper method of lining up the wheels of a Hudson 6-40, 1914 car.—F. B. Elliott.

To line up the front wheels, the best way to do is to first jack up both wheels free of the ground. Then, taking a soft pencil or a piece of chalk, mark a center line on each tire by holding the marker against it when it is being revolved, this being shown in Fig. 8, and the pencil should be held steady so that the line will be as true as possible. Now measure, with a tape or long stick, the distance from the center line of one tire to that of the other, when the tape is the same distance from the ground as the hub. In other words, measure on the tire at a point that is in the same plane with the hub center. Now measure the distance from centerline to centerline directly back of the hub and in the same place. The front distance should be $\frac{1}{8}$ inch to $\frac{3}{8}$ inch less than the rear distance, as shown by Fig. 8, distance A being $\frac{1}{8}$ to $\frac{3}{8}$ inch less than B.

To check the rear wheels see that distances so measured are the same both front and rear of the hub, and that the distance measured from center of front hub to center of rear hub on one side of the car is the same as the corresponding measurement on the other side. In making this front to rear measurement, be sure that the front wheels are set straight ahead.

Experience With a Substitute

Montezuma, Ia.—Editor Motor Age—Some time ago my Stewart speedometer shaft broke and I ordered another of a supply house. One was sent to me lacking the Stewart trademark, and the excuse offered that they were out of the Stewart link-chain type, and as the one forwarded was giving good service they had taken the liberty of sending the substitute. The shaft on the substitute was like the standard Stewart in every way but was of the coil-spring type.

It broke after it had been used about 25 miles, I returned it. The second one hardly ran a mile when it broke a swivel. Not knowing just where the trouble was I put on a new swivel and then the gear broke. I then went to the shaft and found it would catch in certain positions. I returned it to the jobber and asked for a genuine Stewart shaft or my money returned. I received a Stewart shaft and now everything works smoothly. No substitute for me after this.—W. E. McKee.

WHAT IS THE BEST FINAL DRIVE?

Engineers' Opinions Too Diversified to Permit Statement

Marshall, Okla.—Editor Motor Age—Kindly give the advantages and disadvantages of the three types of final drive: differential gear.

2—If one of the rear wheels gets into deep mud, where no traction can be attained, and the other is on dry land, will a car equipped with a worm drive turn the wheel on dry land or will it remain still and the one in the mud revolve?

3—How long has the worm gear been in use?—A Subscriber.

1—If it were possible to do so Motor Age would gladly list the advantages and disadvantages of the various systems of final drive, but motor car engineers hold such a variety of opinions on these points that no positive statement can be made.

2—The differential action in the ordinary worm-gear drive is the same as that in a bevel-type. The wheel in the mud would undoubtedly spin.

3—Motor Age has no record of the first motor car to adopt worm gear drive, but it is safe to say that it was experimented with at least 10 years ago.

THE BORE AND STROKE OF RACERS

List of Motor Sizes of 1916 Speed Jobs Is Given

Kahoka, Mo.—Editor Motor Age—What is the bore and stroke of the following cars: Sunbeam, Delage, Peugeot, Erwin, Crawford, Maxwell, Duesenberg, Mulford Special, Frontenac, DuChesneau and Premier

2—Give the pronunciation of Delage.

3—When did they discontinue using the short stroke in racing cars, or did they ever use it?

4—Which is the more successful, the long or short stroke?—W. J. Wilsey.

1—We are of the opinion that you refer to the racing cars under the names you list and we accordingly give the following data: Sunbeam, 3.21 by 6.14; Delage, 3.74 by 6.29; Peugeot, 3.70 by 6.65; Erwin, 4 by 5.18; Crawford, 3.74 by 6.34; Maxwell, 3.74 by 6.34; Duesenberg, 3.74 by 6.34; Mulford Special, 3.6 by 6.6; Frontenac, 3.87 by 6.375; DuChesneau, 3.26 by 5.50; Premier, 3.66 by 6.625.

2—Daylázsh.

3—Long stroke motors for racing purposes came into prominence in 1912, several motors of this type being evident in the Indianapolis entries of that year.

4—The long-stroke is a fast motor.

Specifications of Stutz Racer

Kokomo, Ind.—In Motor Age, issue April 13, page 20, details of the Wisconsin racing engine were given. Would like further details regarding this car, and also what is the gear ratio Mr.

Stutz used when his cars made the best time.

2—What size of wheel is used?

3—State the relationship existing between the size of motor and the size and weight of balance wheel. Was this relationship altered in this motor and if so in what way?

4—How many pounds per square inch compression has this motor?—Dr. Hale Thompson.

The Stutz Motor Car Co. advises us that it is against its policy to furnish such data as you request.

Overland System Illustrated

Pomeroy, Ia.—Editor Motor Age—Will you please show a diagram in the Clearing House of the U. S. L. system used on the 1913 Overland model 69 T, showing the wiring between the battery starting switch, regulator and generator, also wiring to lighting switch and lamps? Why are there five terminals on the battery?—A Subscriber.

The Overland wiring diagram is illustrated in Fig. 9.

CAR BURNS TOO MUCH GASOLINE

Old Carburetor Will Not Handle Present Low-Grade Fuel

Lyona, Kan.—Editor Motor Age—I have a model 18, 6-54 Chalmers Torpedo 1913 model which is not operating to best advantage.

The car is in excellent mechanical condition, compression uniform, intake valves and guides new and close fitting, cylinders quite free from carbon, intake manifold and joints tight and free from air leaks, gasoline line and trap free from foreign matter, air line to gas tank tight and pressure on gas average about $\frac{1}{2}$ pound, with 2 pounds as the maximum. Nearly new Bosch DU6 magneto handles the ignition with efficiency and all wiring is in good order and spark plugs are spaced properly at points. In short, the car is as good as the mechanics at the Chalmers Service Station in Kansas City, Mo., could make it last October, but they failed to get proper operation without setting the carburetor for excessively rich mixture, which meant 5 or 6 miles per gallon of gas and quick loading up while running slowly or idling. I know of a car of this same model and type that gives 11 to 12 miles per gallon with less careful driving.

The trouble is this: The motor persists in missing and if carburetor is set to run fairly

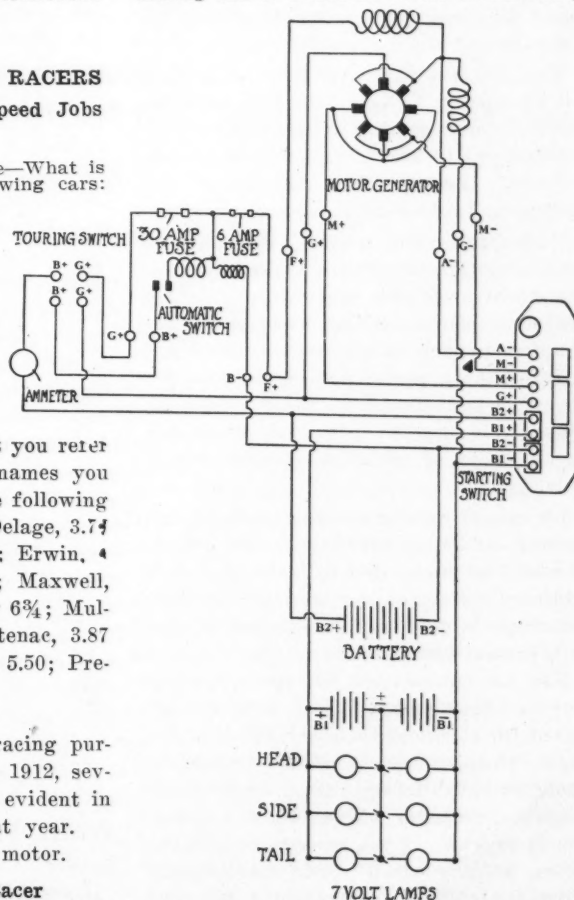


Fig. 9—U. S. L. wiring circuit as used on Overland model 69 T

well at one speed, it will miss and jump or spit back at change of speed. No one has been able to find an all speed setting and an excessive quantity of gas is necessary, resulting in sooty plugs that must be cleaned every few miles, a dry soot, not oily.

The carburetor is a waterjacketed D4 1½-inch Rayfield, factory equipment. Does Motor Age think that same is adapted to handle the present low grade gas in view of the higher grade for which it was made to handle in 1913? I have been considering the installation of a model R Schebler, and a Stewart vacuum gas system. In your opinion what would be the most efficient carburetor, regardless of make or price, under all conditions that could be had for this particular type of motor, embodying maximum power and speed possibilities without the sensitive adjustments peculiar to the older model instruments?

Do you consider the Stewart vacuum gas system adapted to this model car of large piston displacement or do they supply a special system for cars of large requirements, especially at high speeds?

In view of the tendency to reduce piston weights in the late cars, would reasonable boring of these heavy pistons, to reduce weight, be advisable, or would it give a tendency to over-oil. About what per cent is boring the pistons to a reasonable extent calculated to increase the revolutions per minute in a large motor of this or similar type?

What speed should the stock cars of this model develop with 3¼ to 1 gear ratio? Good road and average load, etc., 36 by 4½-inch tires?

What is the maximum horsepower this motor is capable of developing under favorable conditions?—D. E. Bacon.

It is quite evident that the trouble is principally due to the carburetor not being specially designed for present grades of fuel. While Rayfield has a number of these old model carburetors out and doing good service, it is a fact that they were designed for much more volatile fuels, and since that model was brought out, later ones with many improvements to cope with present fuel conditions have been designed. The model G Rayfield is recommended as being adaptable to your motor, and is the latest Rayfield type. Perhaps you could make an equitable exchange.

The old carburetor you are using does not adequately break up the fuel, and this results in more getting to one cylinder than another, with the irregular results you mention. Perhaps the adjustment has something to do with it also.

Undoubtedly the Stewart vacuum fuel feed arrangement would be a big improvement over the pressure system you are now using. Since leakage of air is apt to happen in a system of this kind, it is probably partly responsible also for your gasoline troubles. Leave the tank where it is and put a vacuum feed tank on the front of the dash, if such is possible.

We cannot recommend any make of carburetor as being superior to all others. It would be impossible to make any such arbitrary statement, for most any modern carburetor is good and is designed to cope with present low gasoline.

You are not advised to rebore the pistons to lighten them. They were not designed for this, and such weight reduction might weaken them, besides which, it would be difficult to get them of the same weight, a necessity where balanced operation is sought. If you wish to reduce the piston weight, which would undoubtedly assist the engine's performance and add somewhat to the power, better install aluminum pistons with any one of the well-

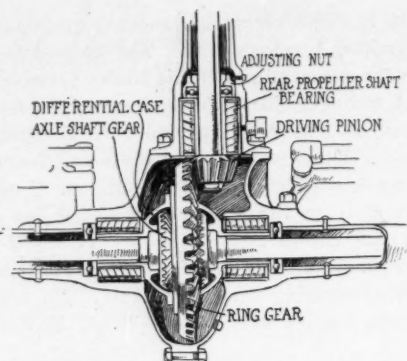


Fig. 10—Buick C-25 rear axle construction

known makes of non-leak piston rings. Remember that the piston assemblies should weigh the same.

This model Chalmers ought to be good for better than 60 miles an hour if in good condition throughout. This motor ought to develop around 50 horsepower, maximum.

QUESTIONS REGARDING AMERICAN Adjustment of Buick C-25 Pinion Gears Explained

Carlyle, Ind.—Editor Motor Age—In good condition what speed should an American Scout model 20 show?

2—Where can parts be obtained for this car?

3—How are the pinion gears adjusted in the differential of a C 25 Buick?

4—What is the maximum speed of the 1916 Hupmobile?

5—How is the tone of a Klaxon horn adjusted?—S. G. Crow.

1—Probably 55 miles an hour.

2—American Motor Parts Co., Indianapolis, Ind.

3—There is but one adjustment in connection with this rear axle, and that governs the mesh of the driving pinion and the ring gear. Remove the inspection plug on the left half of the differential housing just behind the rear propeller-shaft flange. Determine which way the pinion must be moved to mesh correctly. Remove the inspection plate on the right side of the pinion flange, exposing a capstan adjusting nut. Also remove the spring lock which fits around the nut located at the forward end of the propeller shaft housing. If the pinion is to be moved towards the center of the ring gear, loosen the forward nut and tighten the rear nut, being careful to turn each nut an equal amount so as not to disturb the adjustment of the ball thrust bearings in the ends. If the pinion is to be moved away from the center of the ring gear, reverse the operation on the nuts. Be sure to lock the nut in place with the spring and to replace the inspection plate on the pinion flange before calling the job done. The construction is shown in Fig. 10.

4—Between 55 and 60 miles per hour.

5—A diagram and explanation will be given next week.

STRESS PLACED ON THE UNIVERSAL Reader Advances Argument on Strains Imposed in Different Gearset Locations

Chicago—Editor Motor Age—I note in a recent issue of Motor Age your reply to

an inquirer who asked the following question:

Is it not a fact that by having the gearset built in unit with the rear axle as on the Studebaker car that it will cause much less strain and stress on the universal when pulling a low gear?

You have replied that there would be no appreciable difference in stresses on the universal regardless of the position of the gearset.

Permit me to offer a correction: The stress of any transmission member such as a belt or shaft varies inversely as the speed, the power being the same. In other words, a motor car pulling on low gear and with the engine running at a comparatively high speed, would create a lesser stress in that portion of the shaft in front of the gearset than in the portion behind the gearset for the reason that the shaft in front of the gearset is turning at a much higher speed than the section of the shaft behind the gearset.

With the gearset in unit with the rear axle, the universal would be in that portion of the shaft turning at a higher speed and would therefore be under considerably less stress than with the gearset in front of the universal; in fact the stress would be in exact inverse proportion to the speed of the two sections of the shaft, disregarding for the moment the small element of friction.—A. M. Barrett.

FIGURES ON CAR'S PERFORMANCE Reader Tries Mathematics to Prove One Make Superior to Another

Beemer, Neb.—Editor Motor Age—In making comparisons of two cars, or any number of cars, I have figured out the following formulae: Take for example, the 22-70 Mercer and the 1915 model Stutz roadster. This comparison is based on each car going the same distance in the same time and I would like to know Motor Age's opinion as to its accuracy.

Roadster, Mercer 22-70, four-cylinder, 3¼ by 6¾ motor, geared 3.1 to 1.0 on fourth speed, direct, with 32-inch wheels and weighing 3,000 pounds. Motor turns over 979.6 times, 1,102 piston feet, in going ½ mile, and at this crankshaft speed it develops 24.7 horsepower, which gives 1 horsepower for every 121 pounds of car weight.

Roadster, Stutz, four-cylinder, 4¾ by 5½ motor, geared 3.2 to 1 on direct drive, third speed, with 34-inch wheels, and weighing 3,240 pounds. Motor turns over 948.8 times in going ½ mile, 869.7 piston feet, and at this crankshaft speed motor develops 31 horsepower, which gives 1 horsepower for every 103.2 pounds of car weight.

The above gives an approximate comparison, figuring that motors have equal compression. However, it seems to me that another factor should figure in the above comparison and I maintain that as the crank throw on the Mercer is greater than on the Stutz; for equal crankshaft speed the Mercer would deliver about 1.22+ times greater than the Stutz.

I wish Motor Age would carefully check over my figures, particularly that part where the greater crank throw figures in, and let me have its opinion regarding it. Is it not a fair comparison?

Also, inform me where to figure in on a comparison where the motor compression is greater on one motor than on another.

Perhaps it would be more accurate to figure comparatively the piston feet instead of the crank throw variance. Taking the two above cars we find 1,102 piston feet in the Mercer and 869.7 in the Stutz, or 1.26+ greater in the Mercer than the Stutz. Could we figure 1.26+ times greater horsepower to the above Mercer over the Stutz, due to its greater travel in traveling the same distance as the Stutz and in the same time?

If we figure cars on equal piston travel, some cars will go farther than others in the same length of time, due to differences in gear ratios, wheel diameters, and then, too, the

car weight must be figured in to make a fair comparison.

Give me the weight, fully equipped with water, gas and oil and in touring trim of the present four-cylinder Stutz, four-passenger Bulldog on 120 wheelbase, and of the new 22-72 Mercer roadster on 115-inch wheelbase.—Grover Sharp.

Motor Age cannot see that you have any basis for comparison of cars along the lines you mention. In fact, so many factors enter into a comparison of cars that no one has yet come forward with a formula that has been accepted. Just because one motor turns over a greater number of times than another in traveling a given distance is no reason for its being in a better car, or not as good a car. The tires might be larger and that would affect the crankshaft revolutions in going a given distance, just as the gear ratio would affect it. Sometimes a comparison of cars is made on the basis of the number of horsepower per pound, it being logical to suppose that the one with the most power per pound would have the best performance, obviously.

You also say that the car delivering 24.7 horsepower at 979.6 revolutions per minute, would, if considered at an equal engine speed with the one delivering 31 horsepower at 948.8 revolutions, show greater power. This is not correct, for very obviously if the latter delivers more horsepower with less revolutions, if both powers are considered at the same crankshaft speed, the latter will be the greater.

You could not say that because one motor had a greater piston travel per revolution than another it has greater power. The bore and other factors would also have to be taken into consideration. The only sure way to tell whether one motor has more power than another is to test them on the block.

Summing it all up, you can figure any way you want to and almost show by figures that any car is superior to any other. It all depends upon how you figure.

We are not in possession of the weights of these two cars.

POWER IMPULSES IN A TWO-CYCLE

Diagram Showing Tiring in Four-Cylinder Marine Motor

Ellsworth, Pa.—Editor Motor Age—In the January 20 issue of Motor Age, page 81, Fig. 4, is shown a diagram of the frequency of power impulses of four, six, eight and twelve-cylinder, four cycle gas engine. Will Motor Age show a two cycle, four cylinder gasoline motor, $3\frac{1}{2}$ by 7?

2—What would be the horsepower of a two-cycle, four-cylinder this size?

3—Are there any two-cycle, four-cylinder motors made and sold today? If so, who sells them?

4—Was there ever a two-cycle made with a splash oil system? If so, who made it?—James V. Mitchell.

1—A diagram such as shown in Fig. 11 would serve for a two-cycle, four-cylinder engine. The black portions represent the down stroke, which is the power stroke. Besides the explosion, there are also going on in the cylinder exhaust and inlet and in the crankcase compression and exhaust. On the up stroke, represented by the white

Communications Received and Inquiries Answered

A. S. Kingman.....Elmhurst, N. Y.
Paul Love.....Garrettsville, O.
Wright Moore.....Trenton, S. C.
F. B. Elliott.....La Salle, Ill.
W. E. McKee.....Montezuma, Ia.
A Subscriber.....Marshall, Okla.
W. J. Wilsey.....Kahoka, Mo.
Dr. Hale Thomson.....Kokomo, Ind.
A Subscriber.....Pomeroy, Ia.
D. E. Bacon.....Lyona, Kan.
A. M. Barrett.....Chicago, Ill.
James V. Mitchell.....Ellsworth, Pa.
James T. Kinz.....Detroit, Mich.
Victorian.....Victoria, B. C.
Sportsman.....New York City

No communications not signed with the inquirer's full name and address will be answered in this department.

portions, compression, C, is taking place in the cylinder and inlet, I, in the crankcase.

2—This would vary so, depending upon the various design features, etc., that it would be impossible to state.

3—No two-cycle motor car engines to our knowledge.

4—Yes. A great many of the two-cycle marine engines use splash.

THE WEIGHTS OF PISTON METALS Aluminum Less Than Half as Heavy as Cast Iron

Detroit—Editor Motor Age—What is the difference in weight between a $3\frac{1}{2}$ -inch cast iron piston and a $3\frac{1}{2}$ -inch alloy piston?

2—What would be the approximate weight of a pressed steel piston $3\frac{1}{2}$ by $5\frac{1}{4}$ inches and $\frac{1}{8}$ -inch thick?—James T. Kinz.

There are approximately 4 cubic inches in one pound of cast iron, and $10\frac{1}{2}$ cubic inches in one pound of cast aluminum. Of course, pistons of the same diameter in both metals vary greatly in weight according to the design. Assuming, however, that a cast-iron piston of $3\frac{1}{2}$ -inch diameter weighs 2 pounds, then an aluminum piston cast from the same pattern would weight a little less than half as much.

This is only comparative and cannot be made accurate without knowing the weight of one or the other of the pistons.

thus no current is being produced.

2—Approximately $2\frac{1}{4}$ pounds.

His Car Not Fast Enough

Superior, Wis.—Editor Motor Age—I have a Hupmobile, model K, 1915, and would like to

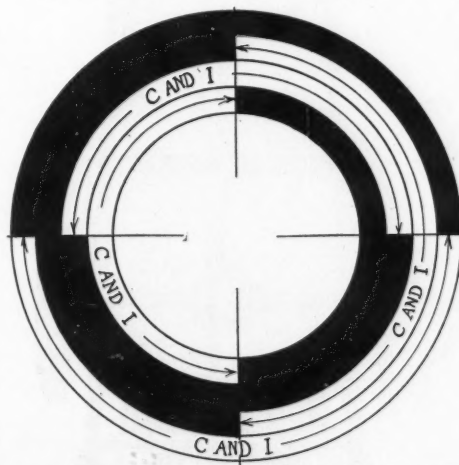


Fig. 11—Diagram of power impulses in two-cycle motor

increase the speed of the car to at least 50 miles per hour. It now runs a little over 40 miles per hour. Would it be advisable to put in a larger gear, and what size would you recommend?

2—What kind of shock absorber would be best to put on this car?—Lionel Larson.

1—Not higher than 3 to 1.

2—Any of the well-known makes ought to work satisfactorily.

DRIVING WITHOUT THE BATTERY Current May Build Up Enough to Burn Out the Windings

Victoria, B. C.—Editor Motor Age—Every issue seems to contain a warning against running the generator on a car with the battery disconnected. I have taken this subject up with several mechanics who have a good knowledge of electrical work and they all claim that it does not harm the generator at all; in fact, they say that when they have cars in their shops under repairs and the battery has been taken out for attention, that they start the motor straight off the generator and run it from that source. Something must be wrong with the information on one side or the other, so I would like to have explained the exact effect of running the generator without the battery.—Victorian.

With the ordinary type of shunt wound generator, there must be a system of regulation to keep the current sufficiently low not to harm the windings. If the battery is disconnected the generator will build up a high voltage when the motor gathers speed, which is very liable to burn out the windings of the generator. Gargemen who tell you they start motors direct from the generators are afflicted by dreams of fancy. When the motor is not revolving the generator is stationary and thus no current is being produced.

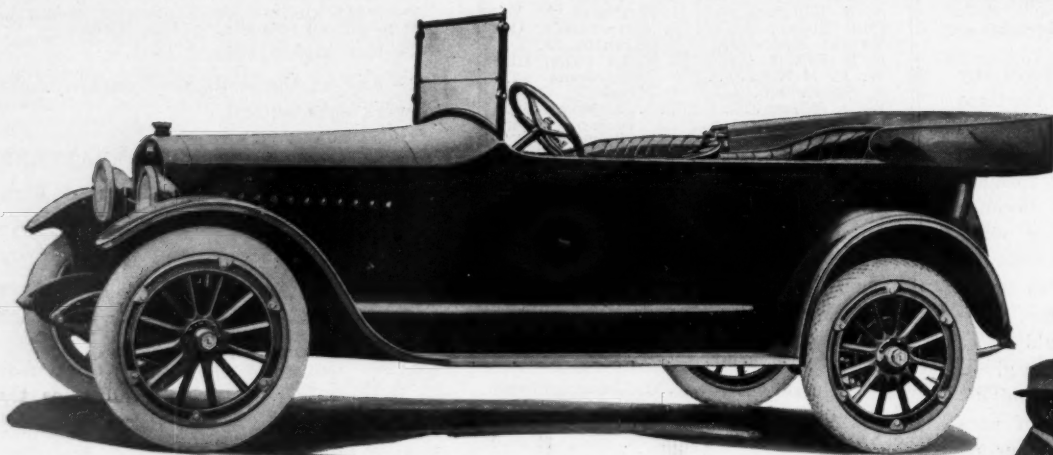
The starter cannot function without electrical current and the only place it can get it is from the storage battery.

REAL SPORTSMANSHIP IN RACING Reader Agrees With Motor Age Editorial of June 15

New York City—Editor Motor Age—The editorial in June 15 Motor Age extolling the sportsmanship shown by Ralph de Palma at Chicago race is to be commended and de Palma richly deserves the praise you bestow upon him.

There was another instance of sterling sportsmanship at the Chicago race which evidently did not fall beneath your notice as I failed to read any mention of it in your article describing the race. I refer to the action taken by Ralph Mulford in allowing both his Peugeot and Hudson to start, notwithstanding that he is not in sympathy with Sunday racing. Due to the refusal of A. A. A. officials to stand out for date specified in entry blank in case of postponement on June 10th, Mulford had no opportunity to compete for either the Chicago purse or for points covering Master Driver prize. Nevertheless when he learned that Rickenbacher was without a mount he offered his Peugeot to the man who is one of his most dangerous rivals for point prize, and also allowed his Hudson to run in order that a number of Hudson agents who came to Chicago would not be disappointed.—Sportsman.

Introduction of New Liberty Six Selling for \$1,095



Touring car of new Liberty, showing straight line body

ALL speculation as to the design and appearance of the Liberty car is now dispelled by the coming of the car itself. The new car is to be manufactured in large quantity by the Liberty Motor Car Co., Detroit, one of the newcomers of last fall, which is headed by Percy Owen, prominent in the field as sales manager of the Chalmers company and later connected with the Saxon concern. Things have been moving rapidly since Mr. Owen organized his new company, and not only are the first cars on the road, but within a very short time the first production models will be coming through.

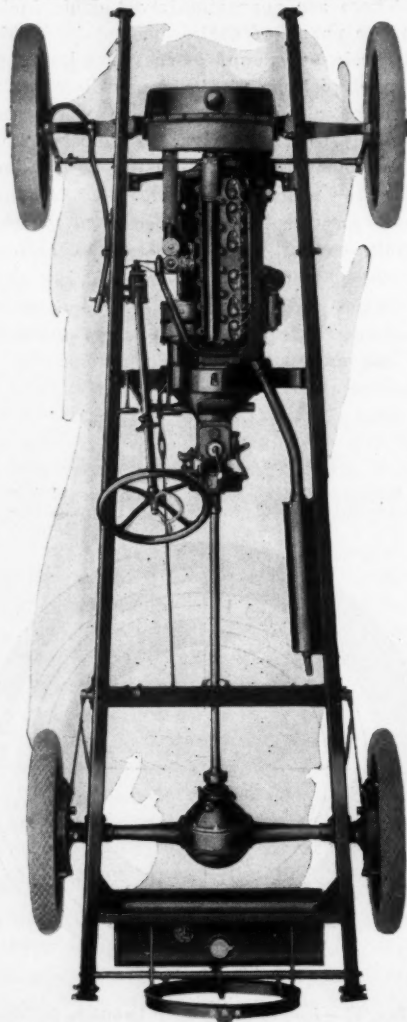
The Liberty might be considered as new in body and general design, though its parts are mostly known to the motor-wise. It has a Continental six-cylinder engine, Delco electric equipment, Timken axles, Borg & Beck clutch, Detroit Gear and Machine Co., gearset, Rayfield carbureter and Stewart vacuum fuel feed, among other features. At present only a five-passenger touring model is to be supplied, and this is to sell for \$1095.

Built on a wheelbase of 115 inches, the Liberty strikes you at first glance with its sharper angles and straighter lines than are usually to be found in the body shapes of the day, but these have been blended into what might be a colonial tendency, the various curves carefully proportioned to produce a harmonious effect. There is no bulge at the sides of the cowl, and simplicity at the front is brought out by the sharp edges of the rather high and narrow radiator, these being carried back by both the hood and the cowl. In addition, the car is hung low, and has a lengthy appearance.

In addition to this unique body design, there is another point that immediately becomes evident upon examination of the chassis. That is the extreme mechanical simplicity. By using the Hotchkiss type of drive through the springs, and by the placing of the emergency brake system forward on the transmission, a point that will be touched upon more in detail later, it has been possible to produce a chassis

that is about the acme of simplicity. No rods of any kind nor other complications are to be found back of the powerplant, with the exception of the one rod which controls the foot brakes on the rear wheel drums. An idea of this can be gained from a glance at the plan view of the chassis.

The six-cylinder motor has a bore of $3\frac{1}{8}$ inches by a stroke of $4\frac{1}{2}$ inches, which dimensions give an N. A. C. C. rating of 23.4 horsepower with a displacement of



Top view of tapered Liberty six chassis

Car Has Continental Motor, Timken Axles and Rayfield Carbureter



Plenty of leg room in Liberty driving compartment

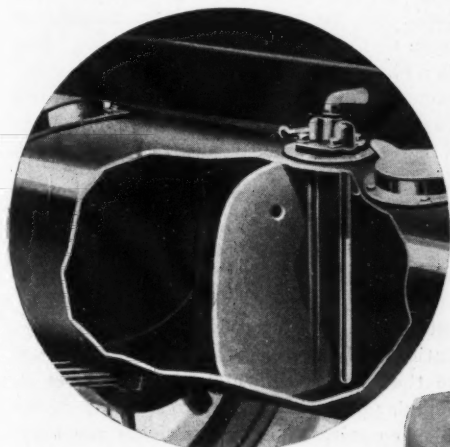
207.1 cubic inches, making it evident that there is plenty of power for the chassis, which is really very light. This powerplant follows usual Continental six-cylinder practice, with the single exception that the cooling system is of the thermo-syphon type instead of being by a pump. In changing to this simplified method of cooling, specially-designed water jackets were formed and rather unusual precaution taken against any restrictions in the water passages due to core sand, core wires, fins or other foreign matter.

Built with the head detachable and the upper portion of the crankcase in unit with the cylinder block, a very rigid and substantial construction results. Being integral with the bearings that carry the crankshaft, there is no possibility of misalignment between the cylinders and the crankshaft—a feature that is conducive of smooth running and absence of vibration. There are three main bearings for both camshaft and crankshaft, and the moving parts are balanced accurately, pistons and their assemblies being of equal weight throughout.

Cast integral with the head is the large water outlet connection, and on the right are the valves and exhaust manifold as well as the generator and fan drive. The carbureter and starting motor are the main units on the left, the former bolting directly to the cylinder casting high up,

with distribution of the incoming gas through cored passages within the casting to the intake ports on the other side. This feature not only makes a simpler motor, but assists in gas vaporization due to the cylinder heat around the passages. Valves are completely enclosed by two pressed steel cover plates.

In line with stand Continental design, the lubrication system is a combination force-feed and splash arrangement, whereby the oil is forced through copper tubes



The Liberty gas tank has two compartments, one being a reserve section

direct to the main bearing and the timing gears by a horizontal plunger pump driven by an eccentric on the camshaft. This lubricant then drains back into the oil pan and maintains the splash troughs under the connecting-rods at a constant level. There is an oil pressure gauge on the instrument board and a filler gauge on the side of the crankcase.

Liberty is among the first to be fitted with the new two-unit Delco starting, lighting and ignition system, in which the ignition distributor and coil are in unit with the generator, the whole being driven by a horizontal shaft on the right, and the starting motor is attached on the opposite side close to the flywheel housing. Starter drive is through the Bendix automatic shifting mechanism, which meshes a pinion with the flywheel gear when the starting current is switched on by a pedal, and automatically demeshes when the engine gets underway and the speed of the flywheel exceeds that of the starter driving shaft. In connection with the control of the ignition distributor, a detail worthy of mention is the use of a flexible wire cable to turn the distributor on the principle of an antenous release. This does away with a complicated set of levers and rods ordinarily employed to actuate the distributor from the lower end of the steering column, especially when the distributor is on the opposite side as in this case.

Clutch and gearset are in unit with the motor, and they are arranged to go together very compactly. This is due in large part to the simple single-plate

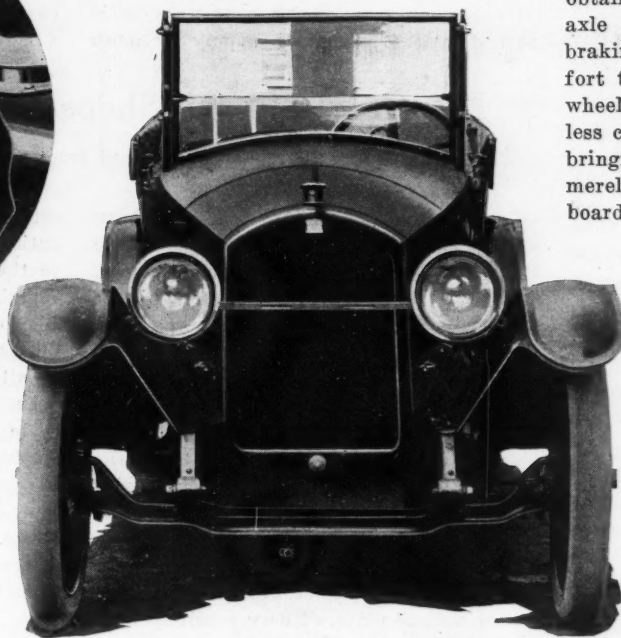
clutch. The plate runs dry and is held in engagement by a pressure of about 2,500 pounds, which is obtained by stepping up the force exerted by a 200-pound spring by means of a series of levers. Thus it is practically an impossibility to have clutch slippage with such a large force holding the engagement, and at the same time a reducing linkage makes the throwout very light, it being possible to depress the clutch pedal with the forefinger. The driven plate is held in engagement between two wire-woven asbestos disks, and due to the clutch design, these can be used until entirely worn out with no detrimental results. Adjustment is only a matter of re-

moving the clutch cover plate and shifting two bolts.

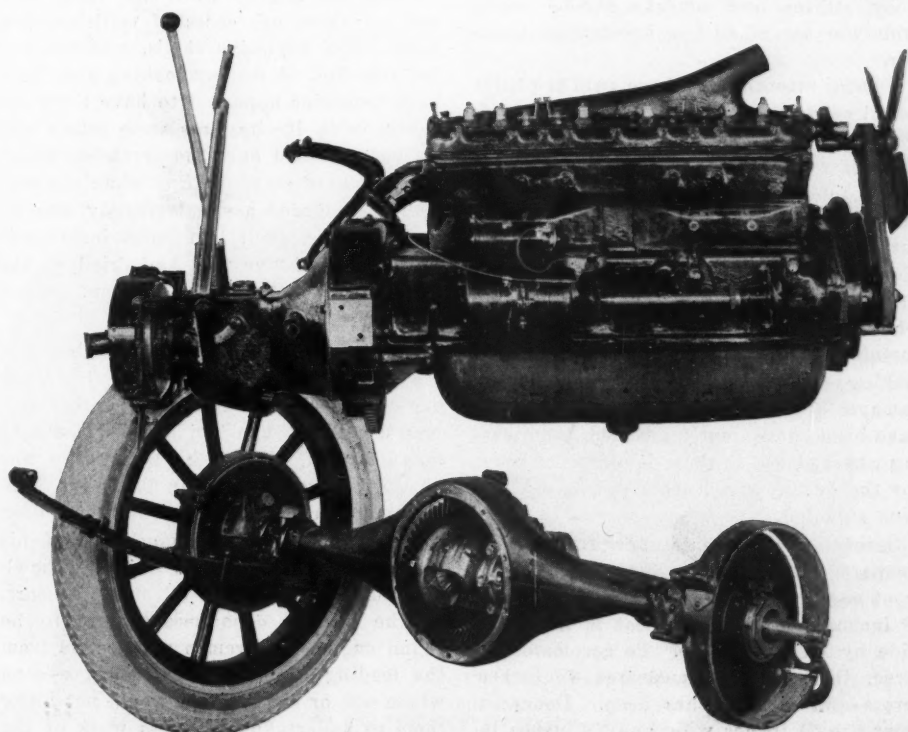
A feature not often found on American cars is the emergency brake on the transmission shaft. This is just back of the gearbox and ahead of the front universal joint, bringing it about as close as it could possibly be to the brake lever. The brake consists simply of a drum on the shaft, with an external contracting band around it, this band carried by a yoke attached to the gearbox. The arm of the brake lever attaches directly to the brake rod, greatly simplifying the control. This type of brake, used extensively on foreign cars, simplifies the rear wheel brake system and obtains the added leverage of the rear axle gear reduction which multiplies the braking effectiveness and makes it less effort to stop the car. Further, both rear wheels get an equal retardation, there is less chance for brake rod rattling and by bringing the brake forward, adjustment is merely a matter of lifting the front floor board. The emergency drum is 8 inches

in diameter by $2\frac{1}{2}$ inches wide, giving a braking surface of 63 square inches. The service brake drums on the rear wheels have external contracting bands, and are controlled in the conventional way, with the equalizer placed under the intermediate cross member of the frame. These drums are 12 inches in diameter by 2 inches wide.

Having incorporated most of the mechanism with the powerplant, even to the bringing of the emergency brake forward, it is evident that the rest of the chassis admits of marked simplicity. The drive shaft, fitted with a universal at either end, is a tubular member



Front view, showing radiator and straight hood lines of Liberty car



Valve side of Continental motor and rear axle opened to show spiral bevel gears in the new Liberty six-cylinder car

that is light in appearance yet amply strong for its work. It conveys the power to a Timken semifloating axle that has a pressed steel housing with axle tubes that are swaged and electrically-welded to the housing. The driving gears are of the spiral-bevel form, and a two-pinion differential is fitted. The whole mechanism is carried on Timken roller bearings; two back of the drive pinion, one either side of the ring gear and one at each wheel. The standard gear ratio is $4\frac{1}{2}$ to 1.

In order to take the drive and torque, as is required of them where the Hotchkiss drive system is employed, the rear springs are of ample size, being 50 inches long by 2 inches wide, with the master leaves plenty large to care for their additional duties. These springs go directly under the frame rails to give good frame support, and are semi-elliptic. The rear end of the frame rails are bent down to take the end of the springs, which go under the axle tubes. Thus the springs are almost flat normally and efficient spring action is obtained, while at the same time the body is hung low. The front springs are also of the flat type and measure 38 inches long by $1\frac{3}{4}$ inches wide.

Frame of Deep Channel

Special mention should be made of the frame, which is not only of a deep channel to form a rigid ground work for the body and running gear, but is a straight taper from front to rear. This allows of a short turning radius of 20 feet, and at the same time makes a substantial support for the body along its entire length. The channel is 5 inches deep, has a width of $2\frac{1}{4}$ inches and is made from $\frac{1}{4}$ -inch metal, these dimensions indicating the sturdiness of this very important part of a car that is often neglected. Freedom from weaving, body strains and squeaks should result from the use of such a substantial member.

Special attention has been paid the little detail refinements that mean much for the convenience of the car owner. At the sides of the windshield, for instance, it is often difficult to make the side curtains fit snugly against rain or wind. To take care of this, rubber strips have been provided here as well as at the bottom of the shield, effectively sealing the compartment when the curtains are up. Then the door curtains are made to swing with the doors, making entrance and egress free without damage to the curtains. Dash instruments have been conveniently grouped, the steering wheel placed so there is plenty of room for the driver, and leather upholstery has been supplied.

Careful measurements show the driving compartment to have a distance from the front edge of the front seat to the dash of 28 inches, and the front seat is 42 inches wide by 16 inches deep. To accommodate three, the rear seat measures 47 inches across and is 18 inches deep. Doors in front are 21 inches wide and 22 inches in the rear, and they are so hung that they

swing level; a valuable foresight in caring for the winter top, which will be provided for the car.

Another feature is the specially-designed gasoline tank at the rear of the chassis. It incorporates a reserve compartment that holds 3 gallons, this being formed by means of a dividing wall perforated by two $\frac{1}{2}$ -inch holes located well up toward the top of the partition. When the main tank is filled to the height of these holes, gasoline flows in to fill the reserve compartment, and two tubes, one on either side of the partition terminating in a three-way cock and leading to the main gasoline line constitute the simple control. Normally fuel is drawn from the main tank, but should this become empty, the control cock is turned and the reserve supply becomes

available. A two-way valve is provided.

Grease cups on the spring shackles and at other chassis points have been tabooed in favor of oil cups. As an example of the installation of these cups, all shackle bolts are drilled and two small wicks are inserted, the bolt being slightly flattened along the line of these wicks. It is explained that the cups are easily filled with oil, and that it has been found that lubrication is more satisfactory this way.

In addition to the five-passenger touring car, the Liberty company expects to build on the same chassis a number of open and closed type bodies. Among these is a close-coupled four-passenger open roadster, besides which there will be a town car that is promised to be of elaborate finish, and equipped for maximum comfort.

French War Repair Shops Models of Systematism

(Continued from page 21)

ice, it is not thrown into the junk heap and allowed to lie there. Its shafts are taken out, its ball bearings are separated, its gears, if of B. N. D. or other high-grade steel, are not thrown into the heap with cheap mild steels; the aluminum casing is not flung in with the cast iron.

The big open-air garage in which considerably more than a thousand war-worn cars are awaiting treatment is one of the most picturesque sights in connection with the war. There is such a variety that it needs a life-long connection with the automobile industry of two continents to identify them without reference to the maker's name plate. Every possible cause has helped to bring them to this common meeting place.

Some are merely worn out from hard service; there are cases of collision, fire, water, high explosive shells, machine gun and rifle fire. A modern looking gray Panhard limousine appeared to have little the matter with it—its tires were intact and its body carried only the scratches which come of hard service. But when the rear door was opened a silent tragedy was revealed, for a shell had burst inside and the blood of brave men had dried on the floor and seats of that once elegant limousine.

All the men connected with this depot are beyond the fighting age. The only one who could lay claim to youthfulness was the officer who had evolved the card index system. For years before the war he had been a salesman in Paris and London motor car showrooms and had been selected for this post on account of his organizing ability and his intimate knowledge of the features of all makes of cars. In the various departments were to be found engineers, foremen and testers from the leading French motor factories—men whose age or constitution would not allow them to undertake the rough work of the trenches, but who were capable of an hon-

est day's labor at a less dangerous occupation. The system of economy was spread to the tools with which the men worked. Tubular chassis built by Renault about 1900 constituted excellent floats for moving material about the yard when stripped of all their organs but the steering gear. Wheelbarrows with a ball-bearing motorcycle wheel and a body made out of a truck side panel cost practically nothing to produce and were more satisfactory than the usual article delivered by the stores. The rough sheds which serve as offices and will have to be pulled down when the war is over, had windows taken from derelict hotel omnibuses. Chain-driven truck rear axles and springs, of which scores could be saved from the wreckage, were almost ideal for field kitchens.

With this system in proper working order, a considerable amount of material is accumulated which cannot be used again in the rebuilding of cars. These comprise stocks of aluminum, copper, brass, sheet steel, high grade steels, mild steel, etc., all of which are sold to the foundries working exclusively for the war department. The state monopolizes metals and eliminates private speculation.

In conjunction with the central receiving and dissecting department is a central repairshop. When this work was begun the repairshop officers were given a wholesale wine merchant's storehouses and yards and told to make the best of it. Within a few months those empty buildings and deserted yards had been transformed into well equipped shops filled with all kinds of cars undergoing or awaiting repair.

The road test department is similar to that of the big factories, for every chassis after assembly must go to the road to be passed by the tester. The authorities have at their disposal a remarkably good class of men for this work.

New $\frac{3}{4}$, 1- $\frac{1}{2}$ and 3-Ton Trucks Announced by Menominee

Small Truck's Price Increased \$170 Over Previous Model

ON top of the greatest production era that the Menominee Motor Truck Co., Menominee, Mich., has had since its origin in 1910 comes its announcement of three new models, one of which is a continuation of the previous $\frac{3}{4}$ -ton truck with a worm drive axle instead of the helical gear drive, an entirely new worm drive 1 $\frac{1}{2}$ -ton known as the model H, and a 3 $\frac{1}{2}$ -ton truck of new design, selling at \$2,775.

The price of the new $\frac{3}{4}$ -ton truck is \$1,295, an increase of \$170 over the selling price of the previous model of the same capacity. The chassis price of the 1 $\frac{1}{2}$ -tonner is \$1,775. Other models sell at \$2,240 for the 2-ton and a 1-ton at \$1,575.

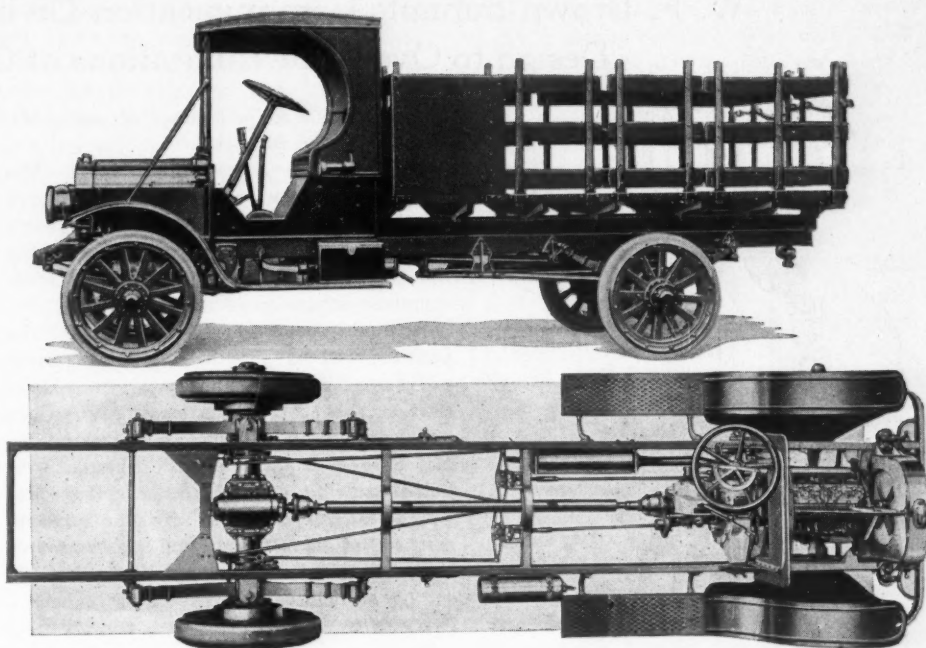
The new model H, 3,000-pound capacity, embodies the several unusual features such as shock-absorbing radiator support, auxiliary springs to prevent overtaxing of the main springs, automatic governor regulating the speed of the trucks, and brake eveners of the universal type designed to eliminate the possibility of rods or yokes binding which have characterized previous Menominee models.

The motor is Continental, three-point suspension unit power plant with 3 $\frac{3}{4}$ -inch bore and 5 $\frac{1}{2}$ -inch stroke. As in all models in this line, the motors are fitted with Stromberg carbureters, Bosch magnetos, and employ the combination and force-feed system of lubrication. The new $\frac{3}{4}$ -ton model EW has a 3 $\frac{3}{4}$ by 5 motor.

The clutches are Brown-Lipe multiple-disk in both models, with gearsets of the same make, three speeds forward and reverse. The smaller model has a 6 to 1 ratio on high and the large truck 9 $\frac{1}{4}$ to 1. Timken worm-drive, floating axles with nickel steel shafts characterize both.

Semi-elliptic springs front and rear are found in both models in addition to the auxiliary springs which take the place of rubber bumpers. The service brakes are external-contracting and the emergency internal-expanding.

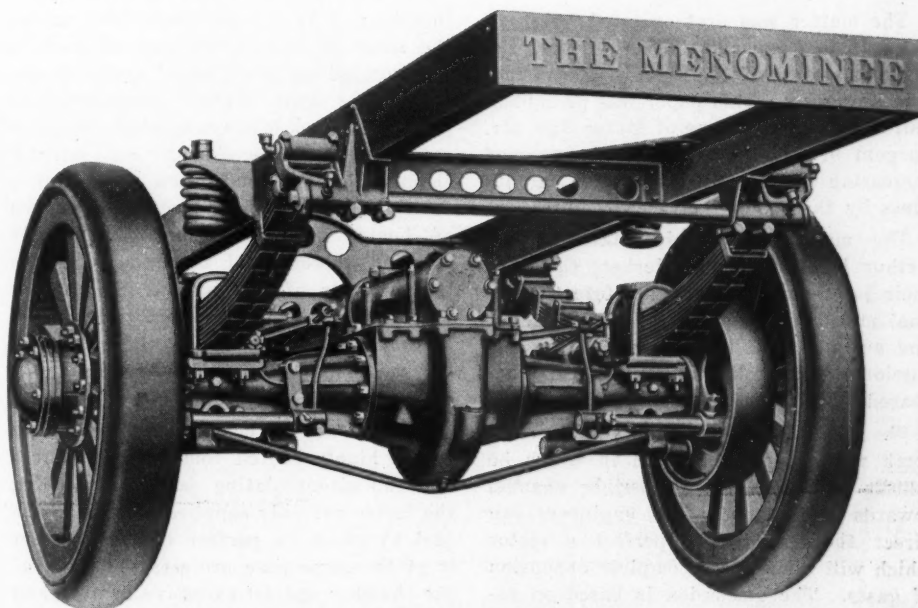
Maximum speed in the model H is regulated by the governor at 15 miles per hour and in the light truck at 25 miles per hour. The former is equipped with solid rubber, demountable or pressed-on type tires 36 by 3 $\frac{1}{2}$ single in the front and 36 by 5 single in the rear. Tire sizes on the $\frac{3}{4}$ -ton are 36 by 4 front and 37 by 5 $\frac{1}{2}$ rear, with an option offered of 34 by 3 $\frac{1}{2}$ front and 34 by 4 rear.



The new Menominee model H stake drive truck and a top view of the chassis



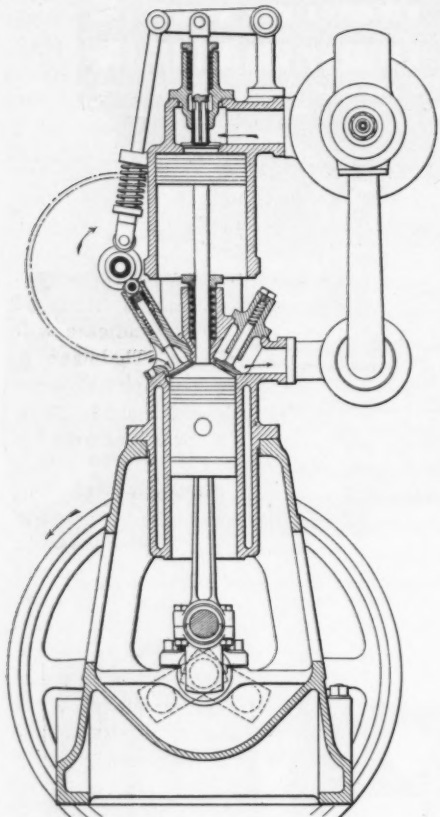
Brake eveners on the Menominee trucks and method of radiator support



Menominee worm drive construction and rear axle suspension, showing auxiliary springs in place of rubber bumpers

Possibilities in High Compression Cylinder Construction

W. F. Brown Submits Communication Giving Details of Motor Design to Overcome Limitations of Otto Cycle



Section of cylinder of Browne motor construction

NO little amount of agitation has been current recently among motor car engineers concerning the limitation of the Otto cycle motor, which is the form of four-cycle construction now universally in use, and a possible solution for this limitation in the form of another type of construction.

The matter was first agitated by C. E. Sargent, in a paper he delivered before the Indiana section of the Society of Automobile Engineers. This paper was printed in full in the April 6 issue of *Motor Age*. Mr. Sargent brought out an unusual means of increasing the efficiency of motor car engines by the use of increased compression.

The matter was again taken up by Arthur B. Browne and Herbert Chase in their joint paper delivered before the annual midsummer meeting of the S. A. E., and an outline of this paper and the discussion which followed its delivery appeared in last week's issue of *Motor Age*.

W. F. Brown, of Chicago, now comes forth with a communication in which he details his ideas of a possible channel towards which motor car engineers can direct their efforts to perfect a motor which will allow more complete expansion of gases. The discussion is based on experimental work that he has conducted

along this line for a number of years. Mr. Brown's letter follows:

Chicago, Ill.—Editor *Motor Age*—The writer has been very much interested in the discussion of Mr. C. E. Sargent's paper as to the possibility of increasing the efficiency of the Otto cycle by more complete expansion of the gases.

It would seem that the solution of the problem will have to be approached from a different angle or angles for the reason that at the best only a small saving can be expected by the means suggested by Mr. Sargent and in unskilled hands it is quite easy to see where a further loss would take place than by the present method of throttling, and furthermore, thermal gains would very likely be offset by mechanical complications.

Price of Gasoline Factor

Probably very few owners of motor cars would give this matter of thermal efficiency much thought if the price of gasoline were to remain say at 10 cents per gallon. So a solution is to produce a satisfactory fuel at a lower price than can be used in the present type of engine.

Some years ago the writer became interested in the study of the internal combustion engines and took up the constant pressure of "Joule" cycle as having possibilities and as this cycle, in the recent discussion, came in for some consideration, it occurred to me to call attention to a patent issued to me some time ago. In mentioning this I have only one object in view and that is to offer a few suggestions for the purpose of creating a further discussion of the cycle, bringing out more fully its good and bad features.

The following is from the patent specification: "In my improved heat engine the same is constructed and adapted to be operated on the 'Joule' cycle or system. The heat energy generated and later converted into mechanical energy is continuously produced in an internal chamber by the combustion therein of a suitable fuel combined with the oxygen of heated compressed air continuously supplied thereto and the mingling with the products of combustion of steam or vapor from the water-circulation jacket, thereby giving to the thus produced working medium a greater degree of entropy or thermo-dynamic properties.

When in use the compressed air supplied to the highly heated combustion chamber and the air-circulating jacket enveloping the latter not only supplies oxygen to the fuel to effect its perfect combustion but it at the same time protects the walls of the chamber against excessive heating and produces a partial reduction of temper-

ature of the products of combustion while in the chamber, the air also mingling later with the products of perfect combustion. At the same time, too, the temperature of the latter is further reduced by the presence of the steam or vapor from the water jacket.

It may be added that the temperature of the products of combustion may be reduced or tempered by the use of compressed air alone but in such case an excessive volume of air would be required, thereby to a great extent reducing the available power of the engine and obviously decreasing its economy.

Therefore, in order to overcome the disadvantages or objections just referred to I provide the combustion chamber with independent air and water jackets, as before stated, by means of which construction the gaseous working medium may be supplied with steam or vapor so as to impart to it a greater degree or percentage of entropy or heat-carrying capacity than can be obtained by the employment of air alone.

Greater Percentage of Expanse

My improved heat engine is capable of producing a much greater percentage of expansibility and overload capacity than has been attainable in heat engines heretofore devised.

In fact its action is quite analogous to that of the steam engine in that the volume of air admitted to the compressor, as well as the volume of working medium entering the working-cylinder of the engine, are automatically controlled by the governor, corresponding with the changes in the load."

The cuts show the application of the idea to stationary engine practice and were only worked out sufficiently for patent office requirements. But the multi-cylinder V-type engine as now used would lend itself to this development of the constant pressure cycle, the combustion chamber and receiver being placed between the cylinders. Some of the cylinders would, of course, be used for compression.

It does not seem to the writer that the proposed engine would be more complicated than the present engine as several accessories used at present would be discarded, namely:

Magneto and spark plugs.

Carbureter.

Variable-speed transmission (perhaps).

Radiator, fan and water circulating pump.

As to thermal efficiency, why should not the proposed engine be as efficient as the present engine? The idea is to so "temper" the gases that they can be used in

an unjacketed working cylinder; in fact it may be possible to protect the cylinder from radiation of heat. The exhaust gases would be ejected at very low temperature, avoiding heat losses at that point.

The water used in the combustion chamber could be passed through the air compressor cylinder jacket on its way to the chamber, so that practically all heat of compression would remain either in the air or water and be carried on to the combustion chamber and there mingle with the products of combustion or working fluid. The work of compression would, of course, be returned to the working cylinder. Therefore it would seem that if the two engines have the same thermal efficiency then the saving will be about in proportion to the difference in the cost of fuel used in each type of engine.

Over 70 Per Cent of Heat Lost

It is generally stated that from 70 per cent to 80 per cent of the heat in the Otto cycle escapes in the jacket water and exhaust gases and this loss in the proposed engine would be materially reduced for there would be no water jacket on the working cylinder to carry off the heat, and the temperature of the working fluid at exhaust would be low, possibly not above 350 degrees. If the cylinders were designed with a stroke to bore ratio of 2 or more to 1, and clearance reduced to a minimum, there is no doubt but that an efficient engine would be the result. It may be stated here that theoretically there is no loss of heat in the tempering process, this is simply a mixing of gases and steam or vapor of different temperatures with the result of an increase in the final volume and lower temperature of a unit of compressed air which has been increased in both temperature and volume in the process of combustion.

As the working fluid for all the cylinders is generated in one chamber, the process of feeding the oil to this chamber is a simple matter as compared to feeding the charge to each individual cylinder as is necessary in the Diesel type of engine.

Of course, no scavenging stroke in this type of engine is required so it would have a power stroke per cylinder to each revolution. This should give a smooth and snappy action.

As the amount of water evaporated in the combustion chamber is not large, the radius of action would be as large as at present; that is to say the fine charge would require renewal as frequently as would the water supply.

In a recent issue of the "Automobile," Mr. Napier takes up the "Possibilities of Double Expansion Engine" and it would appear that the constant pressure cycle is especially well adapted to meet the requirement of compounding. The Otto cycle engine must of necessity have a very large clearance in the high pressure cylinder and in a compound engine when the exhaust from the high pressure cylinder

passes directly to the low pressure cylinder the loss as shown by Mr. Napier is very serious—30 per cent to 40 per cent of the possible saving by compounding. This, of course, includes the loss of water cooling the low pressure cylinder. Practically all of this loss can be saved in the constant pressure engine. In the first place the high pressure cylinder would be designed with the least possible clearance space. With the ratio of stroke to diameter of 2 to 1, probably the clearance would not exceed $2\frac{1}{2}$ per cent.

If this cylinder were partially water-jacketed the jacket water would be carried into the combustion chamber and appear again in the working fluid. In the second place it would not be necessary to cool the low pressure cylinder, as the gases entering this cylinder would be within a workable temperature. It must not be lost sight of that the working fluid proposed has a much higher specific heat value than the products of combustion in the Otto cycle. Probably all attempts in the direction of compounding the internal combustion engine when the Otto cycle has been used with the end in view of higher efficiency have failed to produce the expected results for the reason that the heat losses are so large and the specific heat of the gas used so low that not enough heat is available for conversion into mechanical energy.

In comparing the Otto cycle and the constant pressure cycle it must not be lost

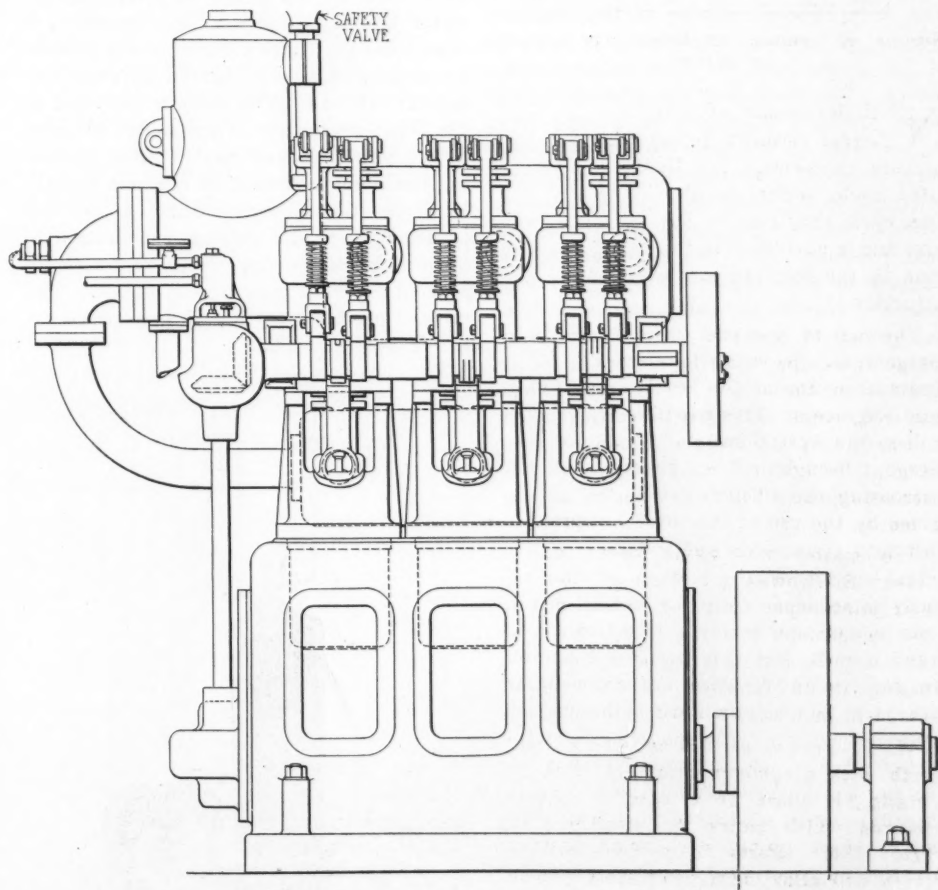
sight of that one is a four-stroke and the other a two-stroke cycle and that there is a 40 per cent heat loss in the cooling water in the Otto cycle which is wholly saved in the constant pressure cycle and added to this a large part of the loss in the rejected exhaust is saved.

There are certainly some good features in the constant pressure cycle. Are they more than balanced by the advantages?—W. F. Brown.

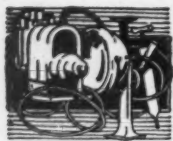
TO UNDERWRITE MITCHELL STOCK

New York City, June 26—The Mitchell Motor Car Co. will acquire the business of the Mitchell-Lewis Motor Car Co., Racine, Wis., as a result of the forming of a syndicate to underwrite the capital stock of the present company. The syndicate will be composed of Ladenburg, Thalmann & Co. and A. G. Decker & Co., and the issue will be of 125,000 shares of common stock without par value. The present capital is \$10,000,000.

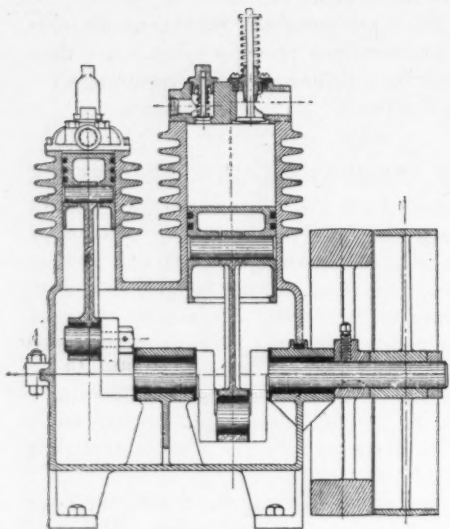
This new financing will enable the company to enlarge its production. The present output is about 15,000 cars a year. It is stated that the company will expend \$100,000 in factory improvements so as to bring the production up to 30,000 cars a year. No change will be made in the directorate, H. L. McClaren remaining president; W. H. Armstrong, secretary; F. L. Mitchell, treasurer; and J. W. Bate, first vice-president and chief engineer.



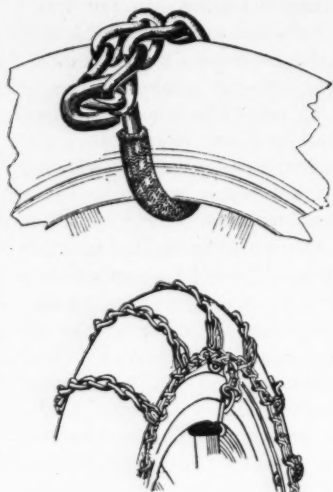
Brown's motor designed for stationary use but applicable to motor car construction, according to the ideas of the designer



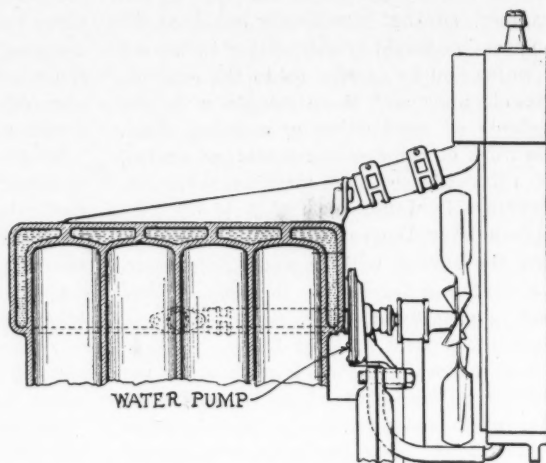
The Accessory Corner



Manley compound air compressor



Hodges mud chain for emergencies and tire chain for regular use



Combination centrifugal pump and fan for Fords

AIR compressors, hand presses, portable benches, and steel engine stands constitute the new line of garage repair accessories manufactured by the United Engine and Mfg. Co., Hanover, Va. The compressors are made in both single-cylinder and compound designs, the latter being featured. The low pressure cylinder of the Manley No. I-C compound compressor has a bore of $3\frac{3}{4}$ inches and the high pressure $2\frac{1}{8}$ inches. The air is first compressed in the large cylinder to about 50 pounds per square inch; at this pressure and at about one-quarter of its original volume, it is delivered to the small or high compression cylinder, which again compresses it to the final pressure. The two-stage method is claimed to give higher efficiency, reduce wear and tear on the compressor and take less power to operate. The Every Way engine stand for repairing motors is metal construction throughout. The uprights are cast iron, cored hollow with vertical slots in which two steel brace clamping nuts travel. The stand is universal in all adjustments and will take any design or size of motor.

Anti-Skid Chains for Every Tire

The most pleasing feature of the recently introduced Hodges Anti-Skid chain, a product of the National Tire Chain Co., Grand Rapids, Mich., is the fact that you can remove and replace the cross-chains with your hands, eliminating the use of any tool whatever. The spoke lock prohibits the wheel from excessive freedom inside the chains, also giving them a great gripping power. These chains are very simple and easy to adjust under all weather conditions. Prices, per pair, are from \$3.50 to \$15, depending on the tire size. Special truck chains, emergency tire chains for quick action when a boost out of a slip-

pery place is needed, and wedge mud chains for deep mud, sand or snow are also products of this company.

Centrifugal Pump for Fords

The Hughes Bull Co., Detroit, Mich., introduces a new and useful accessory for Ford cars in the shape of a centrifugal water circulating pump. It consists of a neatly designed and efficient pump in combination with a fan driven through the regular fan belt. The pump is attached to the front gear cover of the motor in place of the arm which carries the fan, providing for the adjustment of the belt exactly as in the regular equipment. A delivery of from 10 to 15 gallons per minute is claimed for the pump, enough to positively prevent overheating of the motor. The price is \$4.85 complete ready to install.

Gas-Heated Hot Plate

For the motorist who likes to take his family or friends for a day's outing, with

a basket lunch, and who appreciates hot coffee or a fry of fresh-caught fish, the Prest-O-Lite hot plate, which operates on Prest-O-Lite gas, is compact, light and convenient. It is a new product of the Prest-O-Lite Co., Inc., Indianapolis, Ind. The hot plate is packed in a neat carton, 8 by 8 by 5 inches, which weighs 6 pounds complete and can easily be stored away in the tool compartment or under the seat. Turned full on the stove consumes about $3\frac{1}{2}$ feet of gas per hour and the heat of the flame is sufficiently intense to boil a quart of water in three minutes. The cost of operating is said to be about 20 cents per hour of actual use. The price is \$4.50 without the gas tank.

Window Display Paintings

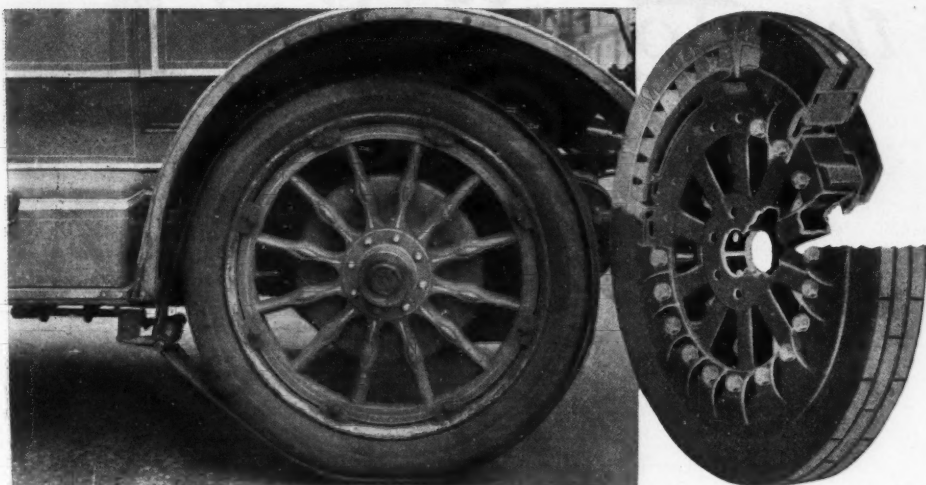
Scenic paintings which may be used in arranging show window displays are made by Bert L. Daly, Dayton, Ohio. A large stock of paintings varying in both subjects and sizes are carried on hand so that any order may be filled immediately. Work is also done on order. Scenic effects are sold by the square foot, the price varying from 15 to 20 cents, according to the size. Paintings under 15 square feet are classed as panels and are sold for \$2 and up.

Self-Lubricating Spring

The Fulton Sales Co., 910 Michigan Ave., Chicago, has introduced the Stanley self-lubricating spring with oil pockets provided in the ends of every leaf so that the springs may be lubricated with an ordinary oil can. The pockets are provided with felt pads which retain the oil so that it is only necessary to supply lubricant two or three times a year. The action of the spring sufficiently distributes the oil throughout the surfaces. Prices for Fords are \$4.50 up; Hudson, \$5 up; Cadillac, \$9.50



A hot plate heated by Prest-O-Lite gas for the roadside lunch



A belt on the tire to eliminate skidding

Steel motor truck wheel of unusual design

up; Packard, \$9.50 up, and other makes in proportion.

Cotter Pin Puller

May's Cotter Pin Puller removes pins of any size at any angle, regardless of how inaccessible or badly bent they may be. It is marketed by the Service Shop, Atlanta, Ga. Pressing the handle operates a ratchet which acts on a rack, the front end of which is formed into a hook which engages the eye of the cotter pin. Pressing the handle a few times draws the hook back and carries the cotter pin with it. The device is simple and powerful, and very little effort is required to operate it. Removing the pin in this way straightens it so that it may be used again, and the construction of the tool is such that it is impossible to drop the pin from the tool. The price is \$1.25.

Tire Belt to Stop Skidding

A recent invention now being marketed by the G. G. No-Skid Tire Belt Co., Seattle, Wash., known as the No-Skid'm, consists of a substantial concave belting wrapped about the tire shoe and guided by an idler pulley fastened to the bottom of the running board. "Lay your own road and pick it up after you," is the principle of the novel device. It is claimed that tests have shown that tire mileage is doubled with the use of the device, and that absolute traction is assured in sand or on slippery pavements. Prices range from \$22.50 to \$37.50 per set, depending on the size of the tires.

Steel Motor Truck Wheel

The resiliency of the giant wheel manufactured by the Giant Truck Wheel Corp., Chicago, Ill., is maintained by placing the rubber in a position in the wheel where it cannot come in contact with any substance that would cause deterioration. It is claimed, therefore, that the wheel will continue to be resilient no matter how long it is used. Economy is claimed for the use of the wheel because the continued resiliency reduces vibration, saving the chassis and motor. The wheel is made of cast steel and the tread from a combination of steel and wood which, it is claimed, will

last two or three times longer than the ordinary rubber tread. There is no flat surface to pull over as in pneumatic or solid-rubber tires.

Roadway Filling Pump

The new gasoline filling station manufactured by the Western Oil Pump and Tank Co., St. Louis, Mo., is a cabinet-encased pump built of 5-16-inch cast iron. The doors overlap, making it weather proof, and they are fitted with Corbin six-tumbler locks. A small door at the bottom of the pedestal gives access to the drain cock of the filler chamber and to the pipe union. The pump is adjusted to measure gallons, half-gallons, quarts or pints at a stroke. But two and one-half turns of the handle are required to discharge a gallon, giving an actual pumping capacity of 13 gallons per minute. The gallon meter keeps an accurate check on all gasoline drawn up to 9,999 gallons, and a discharge register is fitted which automatically tallies every gallon pumped from 0 to 10 gal-

lons and is reversible from any point. It is in plain view of both customer and operator.

Rimless Motoring Goggles

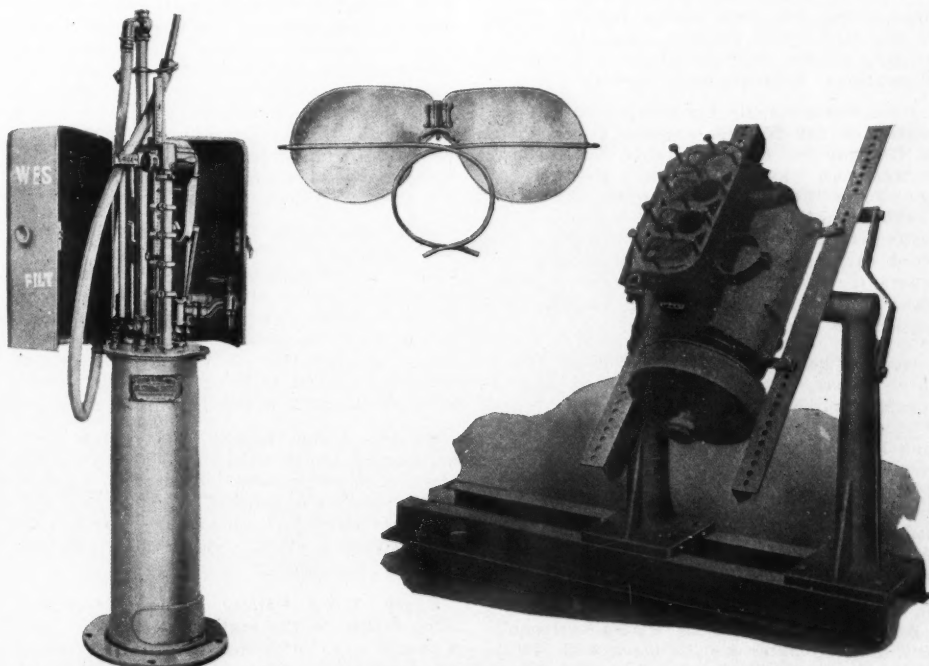
Comfort, protection and perfect ventilation are claimed for the Shur-On autoglass being put out by E. Kirstein Sons Co., Rochester, N. Y. The flexible center-piece is strengthened by two concealed springs, preventing the lenses from drooping and reducing lense breakage. A loop in the bridge arm makes for easy and perfect adjustment. The lenses are ground, first-quality plano meniscus. The list price is \$6.

Pneumatic Grease Gun

The Lewis Pneumatic Grease Gun is designed to handle lubricants of all consistencies from the hardest cup grease to the hardest cylinder oil, and may be used for filling or emptying gear boxes, differentials, etc. It is double acting and self filling. It is 2 inches in diameter and 18 inches long, and is operated by compressed air at pressures of 50 pounds or more. There are two nozzles, one for fluids and the other for heavy greases. It is made by the Lewis Pneumatic Grease Gun Co., Chicago, Ill., and sells for \$10.

Automatic Spark Advance

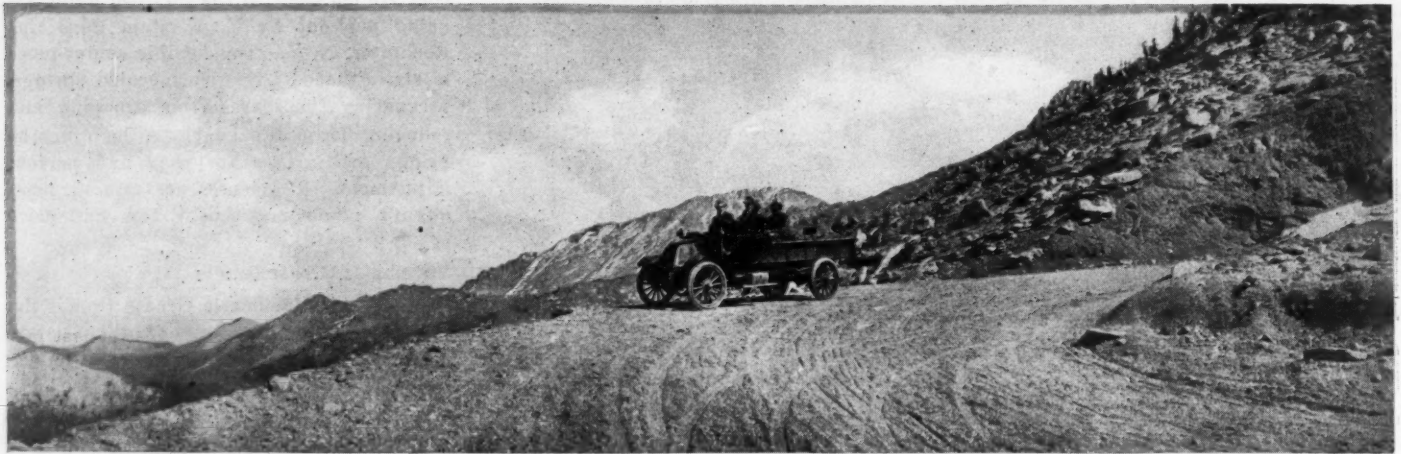
The Automatic Spark Advance Co., Monadnock Bldg., San Francisco, manufactures a new device in which spark is automatically advanced by the centrifugal action of four balls. The driving and driven members of the coupling are constructed so that there are four V-shaped compartments in each one of which there is a ball. One side of the compartment is part of the driving member, and the other part of the driven. As the speed increases the centrifugal force throws the balls outward, and forces the sides of the V apart, thus advancing the spark.



Left—Accurate-measuring roadside filling station. Above—Well ventilated goggles for the tourist. Right—The Manley adjustable motor stand for use in garage repair shops



From the Four Winds



TRUCK MOUNTS PIKE'S PEAK—On June 14th Pike's Peak, famous mountain of the Rampart Range, which was discovered by Zebulon Montgomery Pike in 1806 and successfully climbed for the first time in 1819 by the exploring party of Maj. S. H. Long, at last yielded its cog railway and leg muscle allegiance to a motor truck. The truck, a 2,000-pound International, carrying four men, ran up the world's highest highway as far as it was completed without a mishap and without an adjustment.

At an elevation of 12,000 feet where the truck was finally stopped by falling boulders from the blasting which was in progress on the unfinished part of the road above, the timber line had been left behind and the truck stood within 2,108 feet elevation of the summit.

SALE of Steel Plant Unsuccessful—The plant of the Hess Steel Castings Co., at Bridgeton, N. J., which was abandoned by the company when it moved its business to Baltimore, Md., was put under the hammer, but was withdrawn from sale after an unsuccessful attempt to get \$25,000 for the property. The highest bid was \$14,000 for the brick building, 70 by 320 feet, a two-story brick office building, several other buildings and twenty-five acres of land. All of the equipment except the electric furnaces was sold for junk.

Jitneys Cannot Operate in Suburbs—The new jitney law in New Jersey has crippled transportation between Atlantic City and its suburbs. The jitneys first crippled the local trolley line so that it was forced to cut down its schedule to the suburbs, and now the new law forbids city licensed jitneys doing business except in the limits of the city which licenses them, thus preventing further transportation to Longport, Margate or Ventnor from Atlantic City.

Ford Parts Repair Locomotive—When the engine of the Norfolk express broke down at Georgetown, Del., the other day, a local garage man was an interested spectator of the efforts of the train crew to fix the break. Finally he offered to repair it and was permitted to try. Taking a bolt out of his Ford car, he put it in the big locomotive, where it was needed, and the train pulled away in a few minutes after having been stalled for over an hour.

New School of Instruction—Bradley Institute, Peoria, Ill., has arranged to give a special course in motor car repair work during the present summer school term. One hour and a half each day will be devoted to practical construction work, and the mechanism of the modern automobile, from bumper to tail light, will be shown, demonstrated and explained. Practice in simple garage work, such as trouble shooting, adjusting and valve grinding, will be given.

Arizona's 1917 License Plates—Arizona's 1917 number plates will be black with white numbers, and the head of a white-faced bull on the left side. This design, originated

by Secretary of State Sidney P. Osborn, is intended to symbolize the cattle growing industry, second in importance in Arizona. The 1916 plates are copper-colored, symbolic of copper mining, the leading industry in Arizona.

Pennsylvania Registrations—Up until the close of business June 12 the Pennsylvania State Highway Department received in registration and license fees \$2,002,462, as compared with \$1,665,276 for the entire year of 1915. The estimates for the present year are \$2,225,000.

Milwaukee Plans Show—Plans for the second annual motor show held in connection with the Wisconsin State Fair by the Milwaukee Automobile Dealers, Inc., are rapidly taking definite shape. The association has again leased the entire machinery building and will again charge a small admission fee. The building is one of the largest on the big state fair grounds at West Allis, 5 miles from the Milwaukee city hall. The fair will open Sunday, September 10 and close Saturday, September 16. There will be a motor racing program on Friday and Saturday. The tours committee is preparing for another big booster tour through Wisconsin to advertise the state fair show.

Jail Intoxicated County Official—Charles E. Joyce, of Mt. Holly, N. J., and a freeholder of Burlington county, was arrested for driving his car while intoxicated. Under the New Jersey law there is no alternative but to send the culprit to jail for at least thirty days for this offense, but friends are making an effort to have the conviction set aside or leniency granted.

Electric Motor Sparks Ignite Gasoline—An electric motor whose brushes were well worn gave out sparks that ignited gasoline on the floor of a Millville, N. J., garage and severely burned a mechanic, while the motor, valued at \$125, was ruined by the flames.

Every Third Family Owns Car—Every third family in the state of Nebraska owns a motor car, according to a report issued by Secretary of State Charles Pool. There are now registered with the secretary of

state 76,815 motor cars, which does not include 3,016 motorcycles. Motor car registrations during May totaled 5,650, and conservative estimates indicate that by the end of September there will be in this state one car for every 2.7 families.

Wisconsin Cars Total 110,000—John S. Donald, secretary of state, has issued specifications for furnishing number plates for private owners, dealers and motorcyclists for 1917, and it is interesting to note that the call for bids contemplates a registration of 130,000 motor vehicles by private owners of Wisconsin next year. More than thirty-seven manufacturers of plates will bid for the job. The contract will be for 130,000 sets of plates for cars and 7,000 sets for motorcycles, in addition to 3,000 plates for dealers. Up to this time the secretary of state has issued in excess of 96,000 licenses to private owners, and there is no doubt that the early estimates of a total 1916 registration of 110,000 will be realized, if not exceeded.

Canada Grants Concession—Secretary of State J. S. Schmahu of Minnesota has had notice from the department of public works of Ontario, Canada, that with the co-operation of Minnesota a reciprocal two-week order will be issued covering Minnesota licenses and drivers' badges for twenty-one days. The Minnesota law allows thirty days.

Scott Leaves Master Carburetor—J. Arthur Scott, formerly with the Master Carburetor interests, has been appointed Pacific Coast manager of the H. & N. Carburetor Co., New York, and has established headquarters in Los Angeles.

Bids for Ohio Road Contracts—Bids were opened June 15 by the Ohio Highway Commission for the improvement of approximately 150 miles of roadway in about a score of counties in the state. The bidding was quite spirited and it will take some time to tabulate the bids. The cost of the work is about \$1,300,000. It is the third large letting of road contracts by the commission this year.

Good Roads Day in Ohio—The first good roads day held in Ohio resulted in the im-

provement of a section of approximately 20 miles of road in Allen county last week. In all 150 teams, ten tractors, a number of scarifiers, graders and motor trucks were used in the work. About 1,500 men volunteered to work for a day. The work was under the charge of C. F. Rudisill, state director of the Ohio Good Roads Federation.

Eastern Dixie Open in Fall—That the eastern division of the Dixie Highway, from Cincinnati to Chattanooga, which traverses the Blue Grass region of Kentucky and the picturesque Cumberlands, will be open to tourists late in the fall, is the expectation of the Dixie officials. With the completion of this section of roadway tourists will be able to travel from any point in the northeast straight through to Florida over good roads.

Study Maryland Roads—With the intention of benefiting by observation, the New Castle county, Md., commissioners, who have charge of the roads, have just completed a tour of that section of Maryland east of the Chesapeake Bay, where they made a close study of roads. Maryland has been spending some money on road construction there, and there is a probability of some Delaware connections for some of the roads in that state.

Yellowstone Trail to Atlantic—The Yellowstone Trail Association has announced its route from Chicago to the Atlantic as follows: Hammond, Valparaiso, Plymouth, Warsaw, Pierceton, Columbia City, Fort Wayne, Hicksville, Fremont, Bowling Green, Napoleon, Norwalk, Akron, Warren, Franklin, Oil City, Olean, Hornell, Elmira, Binghamton, Unadilla, Kingston, Salisbury, Norfolk, Hartford, Putnam, Conn.; Providence, Taunton, Middleboro, Plymouth.

Florida Road Fund Wins—The campaign for good roads won by a majority in Polk county, Fla., at the election held early in June. This gives the county a fund of \$1,500,000 for building 220 miles of sand asphalt roads through the county. Contracts have already been let for the construction of this system of roads subject to the carrying of the bond election. The work, therefore, will begin at once. The material specified in the contract is for 2 inches of sheet asphalt on a clay foundation, 4 inches thick after compression under a 10-ton roller.

Pathfinding Jefferson Highway—Directors of the Jefferson Highway Association, headed by President H. H. Orme of the Minnesota State Automobile Association, and J. D. Clarkson, Jefferson highway manager, on June 25 will begin inspection of the highway from St. Joseph, Mo., and three proposed routes in Minnesota to Winnipeg. The points on which the routes will be scored for choice are: Wealth and population of territory traversed; hotel and garage accommodations; condition of roads, improved or unim-

proved; total mileage; soil conditions, topography, availability of material to build year-round roads; scenic value and points of interest.

May Exports from New York—May exports from this city of cars and parts and tires totaled \$8,501,163, as compared with \$8,120,672 in April. Cars and parts valued at \$7,146,232, were exported in May, while the exportation of tires totaled \$1,354,931. Up to the week ending June 17, exports from this port amounted to \$6,934,264, divided into \$2,917,517 for commercial vehicles, \$1,700,239 for passenger cars, \$1,251,161 for parts, and \$1,065,347 for tires.

Toll Bridges May Go—Governor Brumbaugh of Pennsylvania as selected chairman; J. A. Campbell, New Jersey, vice-chairman, and H. W. Darnell, New Jersey, secretary of a joint commission to abolish toll bridges in Pennsylvania and New Jersey. The joint commission held its first meeting at Harrisburg June 13. There are sixteen bridges spanning the Delaware river that charge toll. An effort will be made to purchase two of them with the \$200,000 appropriated by the two states for the purpose.

Ford Ontario Output—It requires from twenty to thirty freight cars each day to handle the Ford company's shipments at Ford, Ont. As the average train is composed of from twenty to thirty cars, the Ford company's shipments average a trainload of cars a day. The largest day's shipment so far this season was 314 cars. As most freight cars will only hold five Ford cars and many carloads go out containing three Ford cars, if the average number is placed at five cars then it requires sixty-three freight cars or two whole trainloads to transport this one day's shipment.

Kansas City Safety Zones Extended—Kansas City will extend its system of safety zones from the close-in downtown business district to the outside business districts and corners of heavy transfer traffic. The street commissioner has been instructed to paint the zones on Grand avenue and Fifteenth street, the two wide north-and-south and east-and-west thoroughfares, for a distance of about 20 blocks southward and twelve blocks eastward from the center of the city.

Gillette Tires August 15—Excellent progress is being made by the Gillette Safety Tire Co., Eau Claire, Wis., on the construction of its new plant and it is expected that the first tires will be coming through before August 15. The main building, the first unit of the proposed group, is 60 by 250 feet. It will be equipped with \$30,000 worth of tire and rubber working machinery purchased from the Adamson Machinery Co., Akron, O., and the total investment at this time will exceed \$75,000.

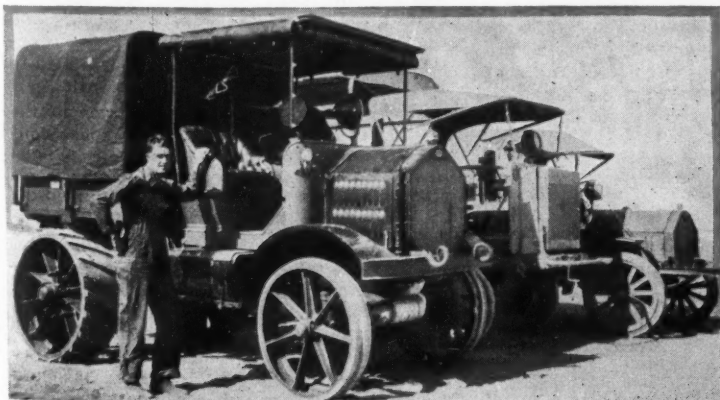
Chalmers Earning \$300,000 per Month—The earnings of the Chalmers Motor Co., Detroit, Mich., it is stated, are running better than \$300,000 per month. In 5 months the sales were more than twice the shipments of any 1 year's business. The sales department to date is several thousand orders ahead of the production.

Guard Against Fires—Garages and other users of waste and rags accumulating oil have received notice from the state fire marshal of Wisconsin to guard against spontaneous combustion, which has caused 127 fires resulting in an aggregate loss of \$232,800 in Wisconsin since January 1. It is recommended that oily waste be placed in metal containers, where fire cannot spread, and that signs be posted directing employees to see to it that all oily material is thus properly cared for each day.

P. R. Mfg. Co. Under Receivership—Following the placing of the P. R. Mfg. Co., maker of motor car parts and accessories and electric bells in the hands of a receiver last fall as a result of a disagreement among the directors of the company as to the financial policy to be followed by the management and the subsequent operation of the plant as a going concern under the receivership of the Security Trust Co., this city, it has now been decided by the Trust company that it will be more advantageous to the creditors and stockholders to sell the real estate of the corporation separately from the tools, equipment and stock. It was the original intention to dispose of the property as a whole as a going business, but at the plant is said to be particularly suitable for many lines of motor car manufacture, it was thought best to sell it in the two parcels above named.

Petition to Remove Tolls—An active endeavor is being made by the citizens of York and York County to do away with existing toll roads, particularly with the toll on the Lincoln highway. Within the country are approximately 30 miles of Lincoln highway which are subject to a toll payment and local feeling is strong for its immediate abolition. Ever since the Lincoln highway has been given to the county, as the greatest and most prominent of its roads, Pennsylvania folk have resented the fact that their section of the road alone subjected the tourist to a toll charge.

Franklin Adds to Plant—Ground has been broken for an extension of the plant of the H. H. Franklin Mfg. Co., Syracuse, N. Y., which will provide 143,000 additional square feet of floor space. This is the fourth important factory addition started by the company within 12 months. Upon completion of the building the plant will have facilities for the production of fifty Franklin cars a day.



TRACTORS IN MEXICO—In demonstrating the Knox tractor to the military authorities in New Mexico, it was put through a series of interesting maneuvers which included driving over a ditch four feet deep. The two Knox tractors are now being used by the engineering department in road building. The accompanying illustration shows one of the tractors hauling a Mogul grader which is cutting 4½ inches of hard-packed soil and delivering it to the center of the road. Due to the sandy condition of the country and the almost absence of rainfall, motor equipment of every description is put to the most severe tests. Trains of motor vehicles are daily being sent into the interior of Mexico accompanied by one or two gasoline tank trucks.



Among the Makers and Dealers



SERVICES FOR MOTORISTS—NOT FOR THE RELIGIOUS—The Dodge Bros., dealers in Port Huron, Mich., have a novel salesroom and service station. It is in a remodeled church and is known as the Church garage, getting the name both from its former use and from Fred S. Church, who is secretary of the company.

OAKLAND Branch Managers Meet—The managers of the six branches of the Oakland Motor Car Co., Pontiac, Mich., were in session at the factory Thursday, Friday and Saturday of last week. This was the annual "get together" of the managers, to talk over past and future business conditions. While in Pontiac they were the guests of the Oakland officials. Those present at the gathering were E. J. Kilborn, Chicago; A. B. Tenbrook, Kansas City; R. S. Shoup, Indianapolis; R. L. Losey, Minneapolis; Z. S. Vertner, Philadelphia, and W. R. Tracy, manager of the Michigan branch at Pontiac.

Alma Garage Changes Hands—C. M. Johnson, Alma, Mich., Ford and Overland distributor for Gratiot county, has purchased the garage, supplies and equipment of A. C. Wyant, Reo and Chalmers distributor, on East Superior Street.

Acme Tire & Repair Co. Purchased—Earle C. Seale and C. C. Van Veen, Detroit, have purchased the Acme Tire & Repair Co. business at 226 Jefferson Avenue. The company is to be renamed the Acme Tire & Supply Co., and headquarters will be at 1745 Woodward Avenue. The firm will do a general repair business and will handle tires of all popular makes.

Porter Starts Tire Manufacture—Manufacture of tires at the plant of the Porter Rubber Co., in Salem, Mass., was begun Friday. More than 200 men will find employment there.

Federal Business Extended—H. T. Dunn, president of the Federal Rubber Co. of Massachusetts, that has acquired the plant of the Federal Rubber Mfg. Co. of Cudahy, says the business is to be extended and several buildings will be erected.

Grant to Build—Grant Motor Car Co. took out a permit yesterday for a \$15,000 factory building, 180 by 520 feet, at 274 Colt Road N. E., Lisbon, Ohio.

Pilliod Co. Bankrupt—The Pilliod Motor Co., of Toledo, Ohio, has filed a bankruptcy petition in United States Court. Liabilities \$30,320.55 and assets \$9,559.92.

Bolt Makers in Grand Rapids—The Albion Bolt Co., Grand Rapids, Mich., incorporated for \$10,000, is to engage in the manufacture of bolts and nuts for motor cars, with the making of other parts as a side line. The officers and organizers of the company are Mark Merriman, president; C. B. Hayes, vice-president; Otto Schwacha, secretary, and W. C. Morrey, treasurer.

Chevrolet Awards Contract—The general contract for the erection of a new building for the Chevrolet Motor Co. in this city has been awarded. The structure will be 50 by 122 feet in size, and when completed will be used for storage and shipping purposes. A one-story garage, 26 by 83 feet, is included in the contract, besides a shipping platform 18½ by 183 feet in length.

Body Makers Increase Stock—The Auto Body Co., Lansing, Mich., will increase its capitalization from \$500,000 to \$1,000,000, the increase having been authorized at a meeting of stockholders Monday afternoon. A 209 per cent dividend was authorized for distribution among stockholders of record July 1, with a cash dividend of 5 per cent June 30. Increase in business for 1916 has necessitated another addition, now in process of building, which will double the shop capacity and add several hundred more men to the present force.

Gas Makers to Build—The Prest-O-Lite Co. announces the immediate construction of a building for its especial use at Locust and Beaumont streets, St. Louis. The offices will be on the Locust Street front, and in the rear will be a service station for all Prest-O-Lite products. There will be a large motor driveway midway of the building on Beaumont, so that cars to be served can enter the building. The building will be ready Sept. 1.

New Motor Truck Makers—The firm of Boyer & Kendall, which has a small factory in Daleville, has begun the manufacture of motor trucks, the first of which are now being placed on the market. An Anderson wholesale concern bought the first completed truck that the factory has put out.

Battery Makers Move Factory—The Detroit Battery Co., maker of storage batteries exclusively for motor cars, is now moving into its new factory, which is a 3-story plant of modern fireproof construction, each floor measuring 100 by 90 feet, the total floor space amounting to 25,000 sq. ft. It is stated that the new quarters will enable a production of 500 batteries a day, a big jump from the present production in the old plant of fifty to seventy-five batteries daily. The Detroit Battery Co. is now several years old, has a capital of \$60,000 and makes its product in sizes to fit any make of car.

Will Make Bodies—The Emerson-Brantingham Co., Rockford, Ill., for 62 years manufacturer of farm implements and now builder of the Big Four and Emerson farm tractors, plans to install about August 1 a department for the manufacture of motor car bodies and fenders.

Disco Increases Capital—The capital stock of the Disco Electric Starter Corp. has been increased from \$250,000 to \$350,000, this enabling plant expansion and increase of production. At the present time fifty Disco starters are being made per day, of which three-fifths are of the two-unit variety and the balance of the single-unit type. Considerable new machinery is to be installed to add greatly to this output, it is said.

Kramer Changes Name—The name of the Kramer Governor Co., maker of a speed controlling device for trucks, has been changed to the Monarch Governor Co. The concern's plant remains at Twelfth and Bethune Sts., at which the output is now about 150 instruments a day.

Dort Buys Land—To take care of increased business, the Dort Motor Car Co., Flint, Mich., which has been building motor cars for about 1 year, and which is the outgrowth of the motor vehicle building operations of the Durant-Dort interests, has purchased several large pieces of land here, on which a \$60,000 plant is to be begun immediately. All the buildings formerly utilized by the Durant-Dort Carriage Co. have also been taken over for the manufacture of cars. Besides, several lots adjacent to present factory buildings have been acquired, for ex-

pansion of these plants. As evidence of the growth of the Dort factories, the carriage works was devoted to car manufacture in April, 1915, with a two-cars-a-day output, and today the production is 60 cars daily, with prospects of its being raised to 100 a day when present expansion is made.

Receiver for Star Truck—Judge E. D. Kinne in the circuit court has appointed A. D. Groves, of Ann Arbor, Mich., receiver for the Star Motor Car Co., of that city, which produces a light truck. The receiver will determine whether or not it is advisable to continue the concern as a going business or sell it.

Ross Increases Sales Staff—Additions to the sales staff of the Ross Automobile Co., of Detroit, are being made by President C. G. McCutcheon, the demands from dealers all over America having compelled the company to place additional leaders of the sales class in the field to care for the rapidly increasing territorial sales.

Yale Makers in New Plant—The Saginaw Motor Car Co., Saginaw, Mich., which was organized and financed by persons in this city, and which is manufacturing the Yale eight for an exclusive selling agent, is now in its plant and expects to make first deliveries about August 1. The officers, all of Saginaw, are: J. A. Cimmerer, president; J. W. Grant, vice-president; W. C. Wiechmann, secretary; H. E. Oppenheimer, treasurer; L. J. Lampke, general manager.

Paige Preparing Winter Tops—Although these are the days when the motor car owners are thinking only of pleasant touring under summer skies, the Paige-Detroit Motor Car Co., anticipating the cold and stormy days that are to come next fall and winter, has already got its production of enclosed cars and winter tops well under way. Special efforts have been made to safeguard the promptness and timeliness of production as well as the exclusive character of this feature of the Paige line.

Foundry Purchases Site—With the intention of tripling its present output, the Lakeside Foundry Co., Muskegon, Mich., producer of automobile castings, has purchased a factory site on Western Ave., between Seventh and Eighth Sts., having a frontage of 270 feet and extending back a block. It is the intention to build a structure measuring 75 by 225 feet with a moulding floor 60 by 150 feet. The present buildings are 60 by 90 feet and the working force fifty-five men, which will be considerably enlarged when the new quarters are occupied.

Schwartz Joins Schavoir Rubber Co.—Arthur J. Schwartz has been appointed general sales manager of the Schavoir Rubber Co., Stamford, Conn., taking office June 26. He leaves the Automobile Tire Co. of New York and was formerly connected with the Continental Caoutchouc Co. of New York City in the early days of the automobile's development. The Schavoir company has recently been compelled to treble its capacity, and plans are now under way for a still greater extension. Mr. Schwartz for the present will be located at the Stamford plant pending the opening of a New York office.

New Buick Chicago Branch Manager—D. A. Burke, long identified with the automobile trade has been appointed Chicago branch manager of the Buick company, succeeding E. T. Strong.

Smith Succeeds Stewart—The directors of the Stewart-Warner Speedometer Corp., Chicago, have elected C. B. Smith to fill the vacancy caused by the death of J. K. Stewart. Mr. Smith was secretary and treasurer. Vice-president T. T. Sullivan has been chosen to assume additional duties of treasurer, and W. J. Zucker has been elected a vice-president and secretary. Mr. Zucker has been elected a director to fill the va-

cancy in the board resulting from Mr. Stewart's death. L. H. La Chance has been elected chairman of the board.

Milwaukee Motor Creditors Get Checks—The creditors of the Milwaukee Motor Car Co., Milwaukee, Wis., bankrupt, are about to receive checks for a third dividend of 20 per cent, amounting to \$53,598.73, declared at a meeting on June 16. At the same time a 100 per cent dividend of \$7,179.89 was declared on wage claims, and a 10 per cent dividend on unsecured claims, amounting to \$2,068.40, making a total payment of \$62,847.02. Final settlement of the bankruptcy is delayed pending the settlement of a claim of \$13,062.35 made by A. J. Farmer, Detroit. A hearing was held on the claim and the matter left open for disposition. There is a sum of \$15,000 left over to cover the claim, if granted.

Overland Distributor to Expand—It is reported that the Overland Wisconsin Co., Milwaukee, Wis., owned by George W. Browne and state distributor of Overland and Willys-Knight cars, soon will establish a large branch house and service station for the benefit of the northern Wisconsin territory at Wausau, Wis. The company has taken an option on a site 60 by 120 feet at First and McIndoe streets, Wausau, and proposes to erect a four-story building of

Akron, O.—Supreme Rubber Co.; capital stock, \$25,000; incorporators, Chester A. Teits, Dan Schmidt, T. J. Seibert, George L. Curtice and Max R. Read.

Boston, Mass.—Non-Skid Co. of America; to manufacture motor vehicles; capital stock, \$200,000; incorporators, R. M. Clark, A. H. Harrington, A. C. Potter.

Buffalo, N. Y.—Ellis-Smith Mfg. Co.; to manufacture motor car specialties; capital stock, \$50,000; incorporators, J. W. Ellis, M. S. Ellis and S. M. Smith.

Chicago, Ill.—Automobile Insurance Service Co.; capital stock, \$5,000; incorporators, L. G. Hurd, G. D. Forkner, L. J. Lally.

Cincinnati, O.—Corcora Mfg. Co.; to manufacture motor car hoods, fenders, bodies and radiators.

Indianapolis, Ind.—Motor Specialty Co.; capital stock, \$10,000; motors; incorporators: Theodore Rees, A. E. Johnson and Clinton D. Leek.

Indianapolis, Ind.—Copple-Lilly Co.; motor car repair; capital stock, \$2,000; incorporators, E. N. Copple, Cora Copple and Gustavus Lilly.

Indianapolis, Ind.—Motor Specialty Co.; to manufacture motor car parts; capital stock, \$10,000; incorporators, Theodore Rees, A. E. Johnson and N. H. Wible.

Recent Incorporations

that size. The investment will be about \$50,000. It is stated that W. R. Stelling, Fort Atkinson, Wis., will have charge as branch manager.

G. J. Bates Joins King—At a banquet tendered to the district sales managers for the King Motor Car Co. at the Detroit Athletic Club, President Artemas Ward, Jr., announced the creation of a new position and the addition to the King executive personnel.

G. J. Bates, for the past 10 years identified with the tire business relinquishes his position with the Firestone Tire and Rubber Co. to become commercial manager for the King Motor Car Co.

Plan Crankshaft Factory—The John Obenberger Forge Co., organized recently with \$200,000 capital by John Obenberger, leading drop forge manufacturer of Milwaukee, has completed plans for its plant to be located at Sixty-third avenue and Lapham Street, West Allis, Milwaukee county. The main shop will be 80 by 150 feet and the power house 50 by 60 feet. The equipment will include a 100 Corliss engine, two 150 horsepower boilers; a 75-kilowatt generator and three motors of 10, 20 and 40 horsepower. The company has announced that it will specialize in motor car forgings and will feature finished crankshafts and camshafts.

Indianapolis, Ind.—Wilbur Johnson Co.; to manufacture and deal in motor cars, parts and accessories; capital stock \$10,000; incorporators, A. B. Baxter, W. C. Johnson, C. R. Fant.

Indianapolis, Ind.—Centaur Motor Co.; capital stock, \$15,000; motor accessories; incorporators, A. M. Robbins, S. O. Dugger,

C. P. Mooney.

Laporte, Ind.—Auto Power Company; capital stock, \$35,000; incorporators, L. R. Russell, L. Darrow, E. L. Van Dolsen.

Milwaukee, Wis.—Federal Rubber Co.; pneumatic tires and mechanical rubber goods; capital stock, \$10,000,000.

New York—North American Rubber Co.; to manufacture tires, tubes, inner casings, etc.; capital stock, \$230,000.

Providence, R. I.—Atlas Machinery Co.; capital stock, \$30,000; incorporators, V. F. Kinne, C. A. Cunningham.

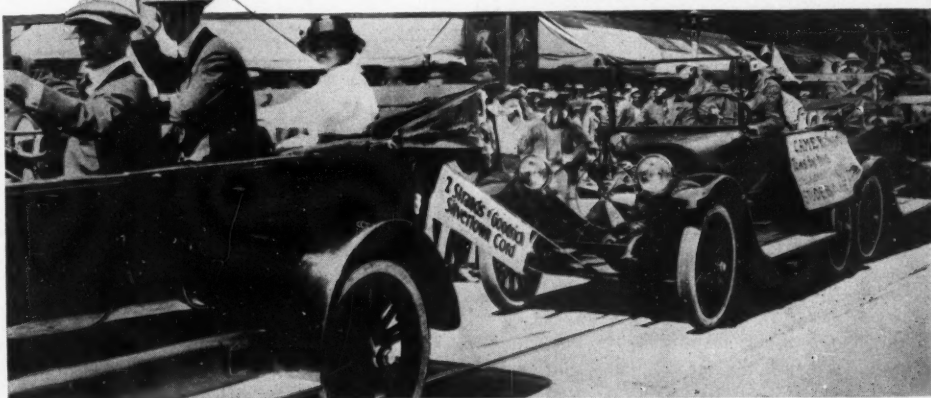
Terre Haute, Ind.—Duplex Tread Tire Co.; capital stock, \$10,000; incorporators: E. C. Meissner, Lucille Meissner and Samuel C. Boyer.

Wilmington, Del.—Metropolitan Motors; capital stock, \$1,000,000.

Wilmington, Del.—Comet Automobile Co.; to manufacture all kinds of engines, motors, machines, etc.; capital, \$1,000,000.

Wilmington, Del.—Hawley Motor Car Co.; to manufacture, sell and deal in and with all kinds of vehicles; capital, \$50,000; incorporators: F. D. Buck, George W. Dillman, K. E. Longfield.

Wilmington, Del.—City Rubber Corp.; to engage in the manufacture and sale of tires, tubes, and casings; capital stock, \$550,000; incorporators, George G. Stiegler, N. T. Parsons, E. E. Wright.



A BITING STORY ON CAR TOWING—Cameron, the man with the iron jaw, reverses the old practice of pulling teeth with a string. He pulled the string with his teeth and on the other end of the string was a life-sized motor car. The string was two strands of Good-year Silverton cord and the car was a Studebaker loaded to its capacity. This feat was performed in San Francisco.

A Hybrid of Motordom



This is the car of fifty-seven parts or more, built with equipment from many makes of machines by C. H. Williams, Goodyear representative

CHARLES H. WILLIAMS, the manager of the Chicago branch of the Goodyear Tire & Rubber Co., when he purchased his motor car, bought it in parts from many sources. As a dealer in tires he wanted to please the companies who make the cars whose owners buy tires from him. He would have liked to buy a machine from each of the different manufacturers, but this being impossible, he did the next best thing and bought some one part of the new car from several.

The little 1,400 pound motor car that resulted from the tactful scheming of the big Goodyear official, is part Ford, part Mercer, part Buick, part Overland, part Stutz, part Hupmobile, part Franklin and so on. Not only that, but in the purchase of accessories for his mongrel he favored almost every accessory firm extant. This political move was made possible by the need of radiator, magneto, carbureter, shock absorbers, wire wheels, speedometer, horn, top and starting and lighting systems.

NEW HAVEN EMBARGO OFF

Hartford, Conn., June 24—For the first time in several months local dealers are able to get their cars direct. The New Haven railroad has lifted the embargo. Heretofore, in fact, back to last February when the first pinch was felt when dealers wanted special cars for the annual show, all cars, or nearly all of them, were shipped into Springfield, Mass. Cadillac, Chalmers, Dodge, Studebaker, Hudson, Stearns-

Knight and Overland cars were shipped to Springfield, where the unloading facilities are much better than in Hartford.

The practice has been to send a crew of men to Springfield on the first morning train, unload the cars and run them over the road to Hartford. Various attempts were made to get around the embargo. The Overland-Hartford company did succeed in getting two trainloads into Hartford. East Hartford, just across the river from Hartford, was not affected by the embargo and some cars for Hartford dealers came there. Reos were shipped to points in New York as well as East Hartford and run over the road.

EFFICIENCY IN CONVICT SQUADS

New York, June 24—Misdemeanant prisoners when working on the roads should be organized in unit squads, if the best results are to be obtained. This is the conclusion reached by James Leland Stamford after a nation-wide investigation of road work for misdemeanant prisoners conducted for the national committee on prisons and the graduate department of highway engineering of Columbia University.

In forty-four states, Mr. Stamford reports, county road work is carried on under the supervision of county commissioners; in other states it is under the control of the sheriff. These authorities are not trained for their work and the road work is costly and inefficient. The county road engineer should not be a political em-

ployee, but thoroughly trained for his work. He should have control of all the road work, whether convict or free labor is employed.

Where convicts are worked each camp should be in charge of a competent superintendent selected by the prison authorities. He should have complete charge of camp equipment, sanitation, and discipline, with power to send a man back to the jail.

Each camp should be divided into unit-squads with a leader to each squad. The squads should be encouraged to elect their own leader from among the prisoners. Special training may be given the squad leaders, who can take the place of foremen or guards. Interest in the squad should be stimulated among the members, as loyalty to the squad will increase efficiency and prevent escapes.

MOTOR CAMP ON CANYON'S RIM

Phoenix, Ariz., June 23—Arizona will have a townsite and motorists' camp on the rim of the Grand Canyon, if Attorney General Jones, State Land Commissioner W. A. Moeur and State Engineer Lamar Cobb, who leave shortly for Washington, succeed in their mission.

Their plan is to have the president vacate three executive orders so far as they affect the townsite that is desired. One of these orders makes the canyon and surrounding country a national forest, one a national monument, and the third makes it a game preserve. A road will then be built to connect the townsite with the Old Trails highway at Flagstaff or Williams. As the state will exercise control over both the road and the townsite, it will then be possible to drive a motor car right to the rim of the canyon. This is forbidden by present government regulations.

Prescott, Ariz., is establishing a free camping ground for motor tourists among the tall pines on the outskirts of the city. A pavilion and tents are being erected and water will be piped to the entire area.

SNOW BALKS PARK ENTRANCE

Idaho Falls, Idaho, June 23—Reports received from the representative of the Utah-Idaho Yellowstone Highway association at Old Faithful Inn, Yellowstone national park, show snow still lying in the road but melting fast on the Continental divide between Geyser basin and Thumb of Lake, from the western entrance at Yellowstone entrance, as well as on the Cody and Gardner routes. It is expected that motor traffic will be permitted on the Western Entrance route clear through by Sunday. In all probability the Cody and Mt. Washington-Gardner routes will not be open until July 4, and possibly later in case of storms. Weather conditions on the western side are sold and backward, with same rain and snow in the foothills and mountains. Telephonic reports from the association agency in Island park, this side of Yellowstone entrance, give rain and some snow.

Big Things Are in Store for Dealers Who Represent



The "Biltwel" Line

Watch the motor publications as well as the great national mediums for Velie news of unusual importance at a near date.

The demand for Velie Biltwel Sixes, tripling the output of a mile of Velie factory, has resulted in plans which mean big business for dealers capable of handling the opportunity.

If this means you, we suggest that you get in touch with us for details now. In the meantime Velie dealers can advise prospects that they will not have an opportunity to buy Velie Biltwel Six at a less figure than its low price today. We cannot prom-

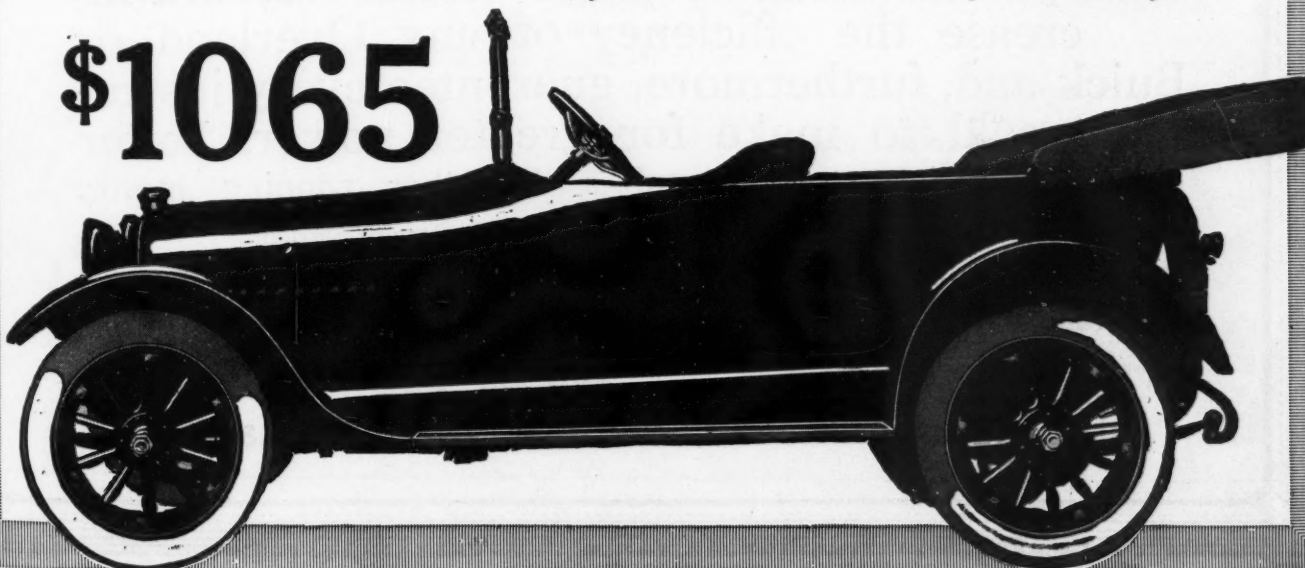
ise that there will be no advance. The present season has proved very clearly that the Velie Biltwel Six quality classes it with cars costing hundreds more.

For workmanship—design—mirror finish—deep-tufted genuine leather and curled hair upholstery—refinements—equipments, it is unsurpassed at any price.

Model 22, Touring Car, \$1065; with Sedan Top, \$1240. Velie Coupe, \$1750. Velie Roadster, \$1045. Wire wheels on any model, \$70 extra.

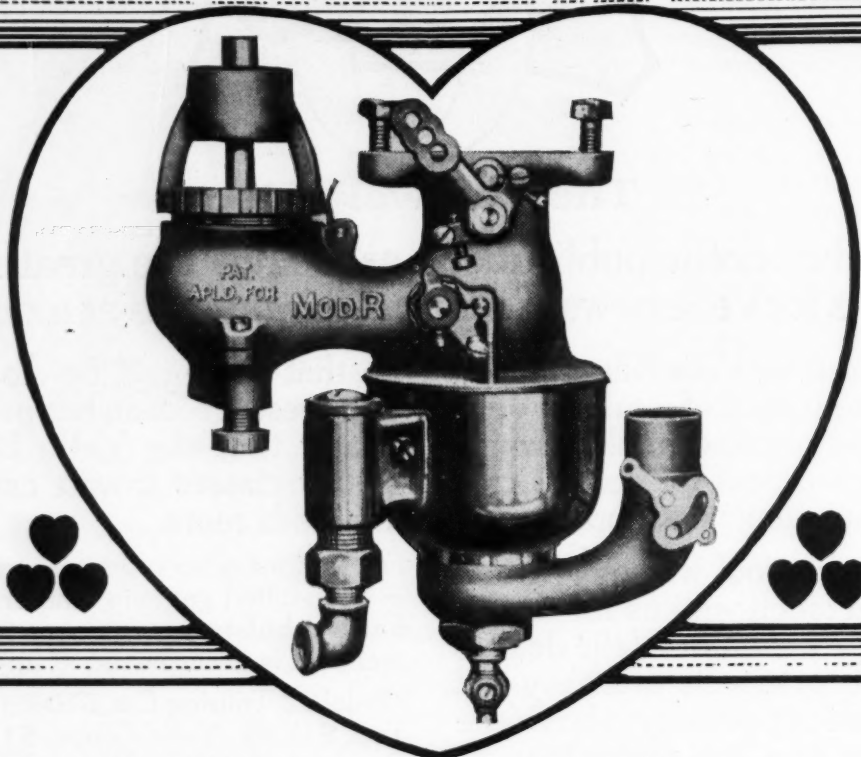
Velie Motor Vehicle Co., 113 Velie Place, Moline, Ill.

\$1065



When Writing to Advertisers, Please Mention Motor Age

Specially Designed for Buick & Overland
SCHEBLER
 MODEL "R" CARBURETOR



WE claim the Schebler Model R carburetor special for Buick and Overland cars will increase the efficiency of any Overland or Buick and, furthermore, guarantee every instrument sold to make for greater power, better economy, easier starting and a smoother running motor.

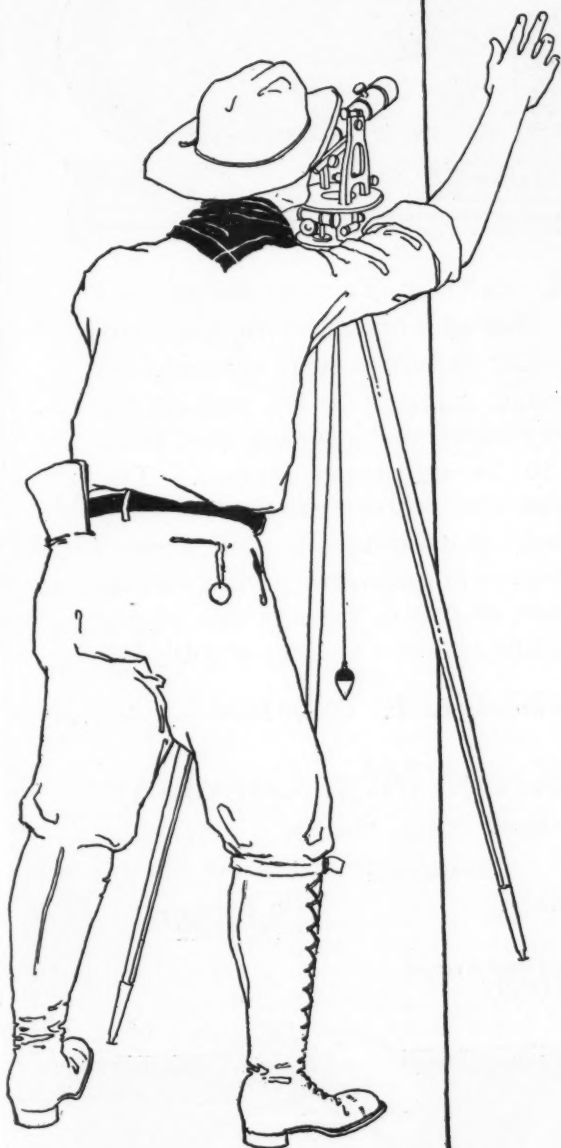
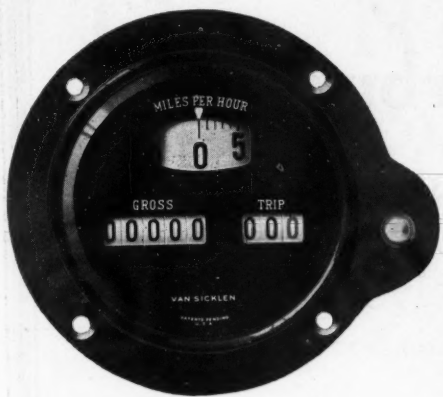
For particulars, call at any of the following Service Stations:

New York.....1673 Broadway
 Boston.....171 Mass. Ave.
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Wheeler & Schebler, Indianapolis, Indiana



*The Surveyor-
only rival for
accuracy to
the*

**VAN SICKLEN
SPEEDMETER**

*"Built Like a Watch by
Elgin Watchmakers"*

The
**VAN SICKLEN
" COMPANY "**
ELGIN · ILLINOIS



"The World's Best Carburetor"

In a contest recently appearing in "*Horseless Age*," asking for the name of the World's Best Carburetor, 430 replies were received.

Of this number 300 contestants selected for this honor

RAYFIELD

CARBURETORS

Owners who equip their cars with Rayfields solve the problem of high fuel cost; for a saving of 10 to 50 per cent is guaranteed in every instance; a *fact* with which dealers are familiar—a *reason* why dealers substitute Rayfields on demonstrators originally equipped with other carburetors.

Car owners will enjoy reading our book, "A Spoonful of Sugar." Ask us for a copy.

A dealer in Tacoma states that the Rayfield installed on his four-cylinder demonstrator increased his mileage from 12 to 20, and on his six-cylinder the increase was from 10 to 18 miles per gallon. The dealer also states that the Rayfield added wonderful flexibility and power. A private owner says: "twice as much mileage out of my gasoline, and no carbon trouble."

Absolute satisfaction or your money back. Order thru any dealer

Findeisen & Kropf Mfg. Company

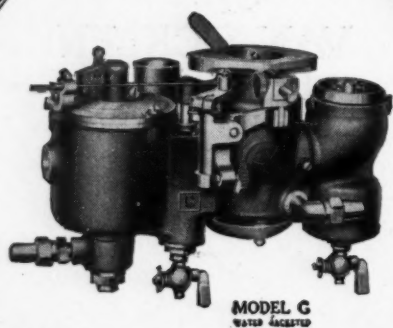
2109 Rockwell Street, Chicago

BRANCHES:

1140 Michigan Avenue
CHICAGO

1902 Broadway
NEW YORK

1191 Woodward Avenue
DETROIT

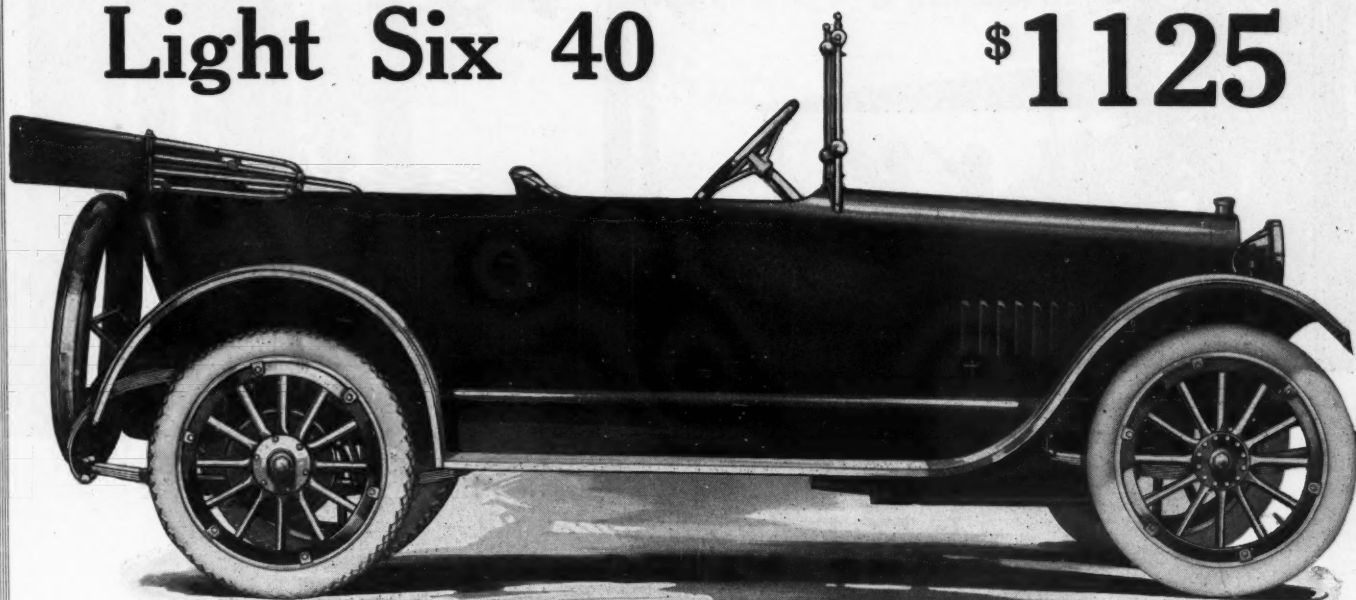


MODEL C
WATER JACKETED



When Writing to Advertisers, Please Mention Motor Age

The New 1917 Glide Light Six 40 \$1125



Our 1917 Platform Omitting all "Glittering Generalities"

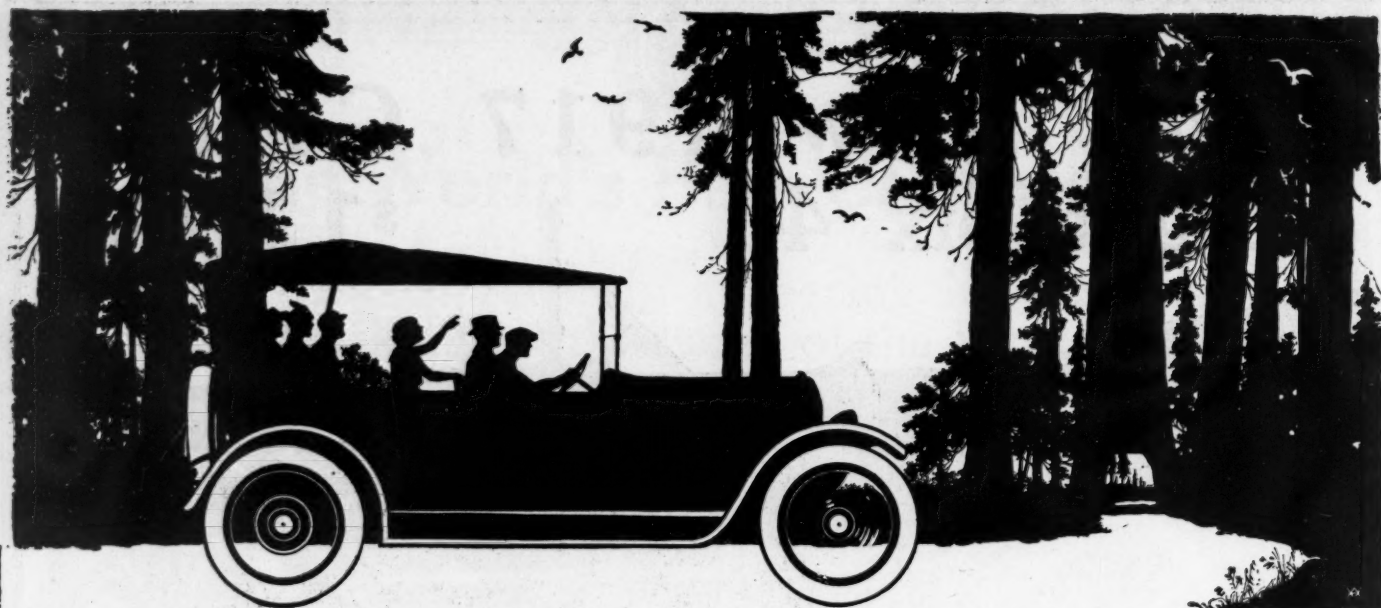
WE are sensible of what our public expects of us, as builders of motor cars of the highest quality. We submit actual specifications of the new 1917 Glide Light Six 40 for the critical analysis of men who sell cars as well as of those who buy them. Begin with body design and end with weight of car. Can experts suggest any better standard by which general excellence can be measured? Judge the Glide from the standard of Quality first and price last.

The true Yacht-like Stream-Line body—unbroken lines from the headlights to the rear of tonneau; a Roomy Tonneau; Flush Type Doors and Concealed Hinges; Superb Finish; Goodyear Demountable Rims; Goodyear 34x4 No-Rim-Cut Tires—non-skid on rear wheels; Rutenber High-Speed Motor, six-cylinder, 31/8x5; 12 Plate, Dry Multiple Disc Clutch; Spicer Dustproof, Self-Oiling Universal Joints; Tubular Propeller Shaft; Spiral Bevel Driving Gears; Pressed Steel Rear Axle-Housing; Brown-Lipe Differential; Hotchkiss Drive;

Crowned Fenders; Rim Type Tire Carrier; Two-Bulb Headlights—conforming with city ordinances for dimming; Linoleum-covered Runboards; Storage Battery under Footboard; Unit Power Plant; Nickel Steel Transmission Gears in Aluminum Case; Stewart-Warner Vacuum Gasoline Feed System; Westinghouse Ignition System; Westinghouse Starter, Bendix Drive; 18 inch Corrugated Walnut Steering Wheel; One-Man Top—5 Bows; Rain Vision Windshield—integral with body; Wheel Base, 119 inches; Weight, 2700 pounds.

*Write or wire today for dealer's proposition and open territory
Catalog on Request*

THE BARTHOLOMEW CO., 215 Glide St., Peoria, Ill.



IN THE REDWOODS
WITH A JEFFERY

BOSCH

IS THE NAME YOU MUST LOOK FOR

AFTER you have faced the pain of ignition breakdown—after you have “forked up” for a magneto so as to have dependable ignition, you will have learned forcefully the necessity for looking for the name “Bosch” on the ignition system of the motor car you buy.

No item of your motor car is as important as is the ignition system.

No item is quite as puzzling or so seemingly mysterious as ignition.

No individual accessory costs the car maker as much.

None can make or mar your motor car so readily.

For these reasons look—look for the name “Bosch” and insist on getting Bosch Magneto Ignition, for then you will have the ignition system recommended by the men who know—the highest priced system, to be sure, but the very best system, the system without a “Big Bogey Man” within itself.

BE SATISFIED

The Motor Car you buy or
sell can be Bosch-Equipt—insist

SPECIFY BOSCH

BOSCH MAGNETO COMPANY

214 WEST 46th STREET



NEW YORK CITY

When Writing to Advertisers, Please Mention Motor Age

AUTOMOBILES ARE SUFFERING

from

"MOTOR DIPHTHERIA"

The Litl Fiend Is a Sure, Guaranteed Cure

EVER hold on your lap a sweet girl baby that was slowly suffocating from Black Diphtheria?

Well, we did.

Agnes was her name, Agnes Cropsy, and she was a Dear of a Babe!

Her "Mom" and "Pop," and all the neighbors stood around crying and wringing their hands when they saw sweet "Aggie" choking with the black mucus in her throat, and not one of them able to do a thing for her.

We were scared blue, because we did love little Aggie. Then the doctor came rushing in. He cut a little hole into her throat and poked in a tiny silver tube.

Aggie got her breath again through that tube, and somehow she held on till the Doctor melted the black stuff out of her throat.

Aggie got well. She grew into a bouncing girl; annexed a "hubby" and had three of the darlinest "Kids" you ever saw.

What ailed Aggie is just what ails most automobiles, they "need air," more air. They're suffering from motor Diphtheria.

We're the Doctor, and we have the little instrument that does the work.

We call it the LITL FIEND.

Once on always on. Needs no attention. Takes care of itself. No adjustment necessary. Absolutely fool-proof.



Cut No. 2.—Shows how the air opening can be shut to demonstrate the working of the LITL FIEND.



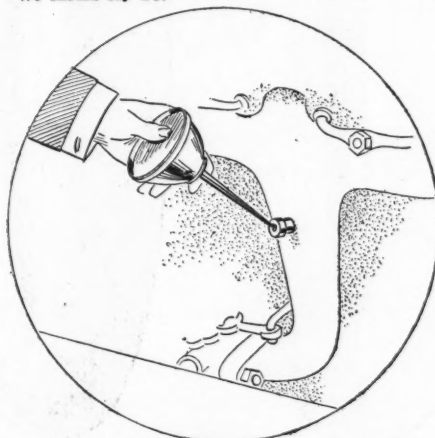
This shows the LITL FIEND enlarged in size. One end screws into the intake manifold of engine. Air enters through automatic valve at other end. Drill a 11/32" hole, and tap threads with a 1/8" pipe tap. The LITL FIEND can then be screwed in.

Easy to attach. Used on any car. Lasts forever.

Burns more air instead of gasoline. Saves money. Gives more power, speed and mileage. Cannot fail.

We bore a little hole into the manifold intake of your choked-up automobile (just a bit of operation), we screw the LITL FIEND into the opening, and here is the result:

More Power.
More Speed.
More Mileage.
Less Carbon.
Less Gasoline.
More ability to take hills on high.
Better running motor all around.
Pretty good for the Doctor, and his LITL FIEND, eh?
We should say SO.



Cut No. 1.—Shows how the engine can be primed with gasoline to make starting easy in cold weather. It also shows the "Water Cure" for Carbon.

PROVING OUR CASE

To prove our case before your eyes, we lift the hood and press one finger against the air opening of the LITL FIEND.

Your motor chokes up, gets that "smothered" feeling, and literally "dies" down.

We take our finger off, and your motor clears its throat and sings like the lark.

It seems almost unbelievable that a device so small can do work so immense.

Applied in a few minutes to a gasoline engine, the LITL FIEND will increase mileage from 10% to 50%.

and at the same time give more power and speed on hills or on the level.

Many hills that you were unable to take on high before, become easy with the LITL FIEND on your car.

One gallon of gasoline, which formerly meant only 10 miles, now means 12 to 15; or, if formerly you were getting 15, 16 or 18 miles per gallon, your mileage will increase to 18, 20, 24, 25 or 30.

One thing is sure and guaranteed—you will positively get MORE MILEAGE, speed and power after the LITL FIEND has been attached to your car.

Burns Free Air

The LITL FIEND makes your car burn air that is free instead of gasoline that comes high.

The mixture of gasoline and air, as it leaves the carburetor on its way through the intake manifold to the

firing chamber of the motor, will be better if allowed to absorb additional fresh air.

This is well known to every motorist.

The LITL FIEND lets in the necessary amount of air automatically, and for every particle of air injected a certain amount of gasoline is saved.

The LITL FIEND relieves the suction in the carburetor, and less suction means less gasoline.

At very low engine speed, as when cranking, or when the engine is slowed down on a hard pull in high gear, the LITL FIEND automatically closes shutting off the air, and allowing a richer mixture.

In this particular the LITL FIEND differs from other similar devices.

With other similar devices it is necessary to close the air vent in cold weather in order to start the motor.

MAKES STARTING EASY.

The spout of an ordinary oil can, filled with gasoline, may be inserted into the LITL FIEND and gasoline be injected into the intake manifold for priming. (See Cut No. 1).

This method of priming is more effective than through priming cups directly into the cylinders.

As a primer alone the LITL FIEND is worth many times its cost to any automobile owner.

WATER CURE FOR CARBON

The oil can may also be filled with water, and the water be injected through the LITL FIEND while the engine is running. The explosion converts the water spray into steam, which removes carbon deposits on the cylinder walls and piston head.

This we call the "Water Cure" for carbon.

Read What Others Say Who Have Tried the Litl Fiend

The Litl Fiend is giving me more power and speed and mileage per gallon of gasoline. A wise investment for any car owner.

W. L. GORDON.
Makes motor run better, smoother and quieter—more power on hills, more miles per gallon of gasoline.

EDW. W. GREENO.
22 miles per gallon without Litl Fiend; 30.8 miles per gallon with Litl Fiend; 40% increase with Ford Roadster.

C. E. HOMAN.
Just arrived in Toledo from Cincinnati. Averaged 20 miles per gallon without Litl Fiend, 28 miles per gallon with Litl Fiend. Motor running great.

C. J. LANDMAN.
Have been driving ten years. Litl Fiend is best device I ever saw. Glad to recommend it.

GEO. W. SMITH.

You can do as well

White Mfg. Co.,
Dept. M. A., Cincinnati, O.

Enclosed find \$2, for which please send me one Litl Fiend.

If I am not absolutely satisfied with it you are to return my money if I return the Litl Fiend to you within 15 days.

Name

Address

Dealer's name

Address

Dealers — Salesmen — Wanted

The Litl Fiend is way ahead of any other similar device. Performance and price (only \$2.00) make it a rapid-fire winner. Visit, wire or write if you want to make some real money.

The White Mfg. Company

Distributors

Litl Fiend—Gas-Tonic—Litl Sho-Fur

Bodman Bldg., Cincinnati, Ohio

REFERENCES

Court House Savings Bank, Cincinnati
DUN OR BRADSTREET'S

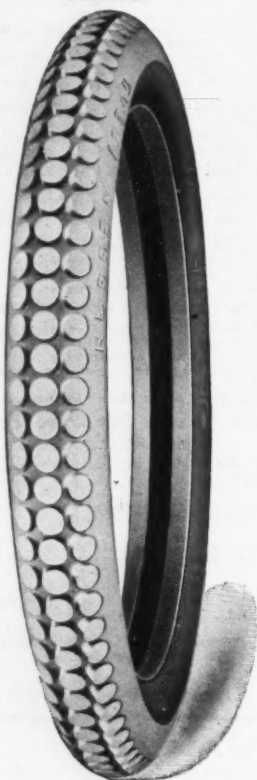
When Writing to Advertisers, Please Mention Motor Age

FEDERAL

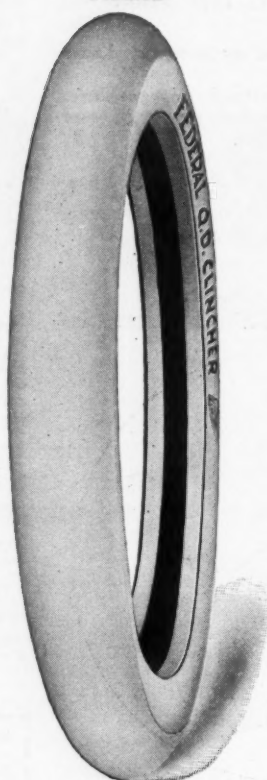
(DOUBLE-CABLE-BASE)

TIRES

**RUGGED (White)
TREAD**



**PLAIN (White)
TREAD**



**TRAFFIK (Black)
TREAD**



**PLAIN (Black)
TREAD**



BUILT FOR EXTRA SERVICE

Attractive Sales Proposition for Jobbers and Distributors

THE FEDERAL RUBBER CO.

OF ILLINOIS

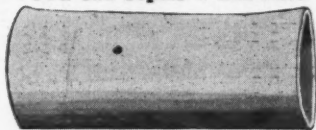
FACTORIES: CUDAHY, WISCONSIN

Manufacturers of Federal Automobile Tires, Tubes and Sundries, Motorcycle, Bicycle and Carriage Tires, Rubber Heels, Horse Shoe Pads, Rubber Matting and Mechanical Rubber Goods

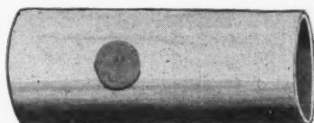
When Writing to Advertisers, Please Mention Motor Age

You Can Cut a LOCKTITE Patch to Repair ANY SIZE Puncture

You can repair a nail-hole



Like this in 5 minutes for 1 cent



You can cut a LOCKTITE patch to any desired size—no waste—no delay—always ready.

100 Repairs for Less Than 1c Apiece

WHETHER you have a nail hole puncture or a 10-inch gash in your tube, you can repair it with a LOCKTITE Patch. LOCKTITE Patches are more economical than ready-cut patches which are adapted for use on small punctures only. You simply cut a LOCKTITE Patch to conform to the size of the puncture or gash you have to repair. There is no waste. There is no delay, for anyone can make a repair with LOCKTITE anywhere, en tour, or at home in the garage.

No tools are required to make a LOCKTITE repair. All you need is a pocket knife to cut the patch, and your two hands to apply it.

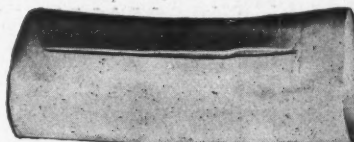
GUARANTEED! We guarantee LOCKTITE will make a permanent repair on any size cut in a motor car tube. We guarantee a LOCKTITE Patch to never burn off—to never leak. Money refunded if not satisfactory.



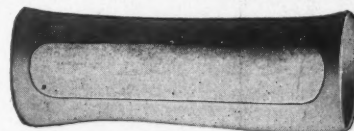
DETROIT

MICHIGAN

Or you can repair an 8-inch cut



Like this in 10 minutes for 30c



Just Stick It On

LOCKTITE Patches hold in spite of highest air pressure, hottest roads and hardest service. LOCKTITE is the original canvas-backed patch. It is the only cementless canvas-backed patch. LOCKTITE is a cold patch. Applied either with or without cement.

Send 10c for Sample Sufficient for Several Repairs

SUPPLIED IN 3 SIZES

OUTFIT No. 1, sufficient to repair 250 nail punctures. Price, complete, \$1.60.

OUTFIT No. 2, sufficient for 100 repairs. Price, complete, 90c.

OUTFIT No. 3, sufficient for 50 ordinary repairs. Price, complete, 50c.



Illustrating handy airtight container in which LOCKTITE is supplied. Fits in toolbox. Ready for instant use.



Obtainable from most good dealers, garagemen, repairmen and supply stores. If your dealer cannot supply you, outfit will be sent direct post-paid on receipt of price.

DEALERS: LOCKTITE is one of the fastest-selling toolbox necessities of the year. Every customer needs it, and wants it. Car owners come back for more in big re-orders. Liberal discounts. Desirable territory still open. Immediate action necessary. Wire or write today.

Locktite Patch Co.
DETROIT, MICHIGAN

USE THIS COUPON

LOCKTITE PATCH COMPANY,
Detroit, Michigan

Enclosed find 10c, for which send me sample of Locktite sufficient to make several repairs.

Name

Street and City.....

County and State.....

My Dealer is.....



This Month Devoted to Furniture Dealers

During July we are putting special force to bear on furniture dealers, just as in other months we are selecting individualized industries for the big punch.

Thousands of furniture dealers, manufacturers, movers are having the Smith Form-a-Truck brought to their attention in the biggest sort of a way—just as Contractors were reached in June—as Grocers will be reached in August.

The Smith Form-a-Truck is a rear end attachment which fits over the frame of any Ford car and gives a one-ton truck with 125 inch wheelbase and 9 foot loading space back of driver's seat. Frame is channel steel, 4 inches deep, strongly reinforced with three cross members and gusset plates at the rear. The double chain drive uses the Ford rear axle as a jackshaft. Wheels are wood artillery type with large spokes and Firestone solid truck type tires 32x3½ inches. The Smith Form-a-Truck rear axle carries 90% of the load.

Whatever your line of business, the Smith Form-a-Truck will show a four to one time saving over horse drawn delivery and a 50% saving in investment over any other fully guaranteed truck of equal capacity.

CUT THIS OUT—MAIL TODAY

SMITH FORM-A-TRUCK CO.
Suite 913, Smith Form-a-Truck Building,
1470 Michigan Avenue, Chicago, Illinois.

Gentlemen:—If you can prove to me that your Smith Form-a-Truck is the cheapest transportation in the world, I am interested; so send me booklet—"It Solves Your Delivery Problem." No obligation on my part.

My business is.....

I can use.....trucks

Name.....

Address.....

I suggest as a good dealer.....

WARNING

To Prospective Purchasers of Truck Attachments

Since the introduction of the Smith Form-a-Truck, numerous imitations and many so-called truck "conversions" intended to secure results similar to those secured by the Smith Form-a-Truck attachment, have been placed on the market.

We control the basic patent rights to the chain-driven truck attachment and are prosecuting vigorously any and all infringements of these rights. For the benefit of buyers in general, we wish to advise that users are equally responsible with manufacturers of any infringing attachments.

Beware of Imitations!!

SMITH Form-a-Truck COMPANY

Suite 913, Smith Form-a-Truck Building,
1470 Michigan Ave. Chicago, Illinois



The Big Chance for Every Live Dealer

The big live dealer—the leader in his vicinity is the dealer in Smith Form-a-Trucks. Contracts from dealers alone already total \$13,000,000 and in practically every case the original contract has been doubled, and in many cases trebled within a few weeks after it was originally signed.

The big reason is the success of the Smith Form-a-Truck—the biggest selling truck ever built—and a truck which in volume of business alone exceeds even the majority of the most successful pleasure cars.

As a money maker for dealers it is the biggest proposition in the field—as a money saver for users it is setting new records in every kind of business. Write today! Use this Coupon.

CUT THIS OUT—MAIL TODAY

SMITH FORM-A-TRUCK CO.
913 Smith Form-a-Truck Building
1470 Michigan Ave., Chicago, Illinois.

Dear Sirs:—I am an automobile dealer and am interested in your dealer proposition. I will be glad to have you take it up with me with the understanding that this request incurs no obligation on my part.

I sell.....cars;

could probably sell.....Smith Form-a-Trucks.

Name.....

Address.....

STEPHENS SIX



Consider the Great Concern Back of It and Back of You

Suppose two competing cars are identical in construction, appearance and performance on the road. Which car would motorists prefer, and which would you choose to sell?

You would say "there's no choice," until you found out *who produced* one, and *who manufactured* the other.

For one maker might be strong, reliable and *permanent*, while the other was *insecure*. If there was that *one* difference between the two cars your choice would require hardly more than a moment.

So kindly consider this fact before you choose a car of this class:

The double-strength forty-horsepower *Stephens Six* presents the utmost value, for its price. It is the product of a staff of expert engineers gathered together from some of America's best known motor car factories. It forecasts the car of 1917 in practically all details. It is strong, light in weight, easy to handle and safe. Adjustable foot pedals enable women and their daughters to drive it. The drive, like the costliest of cars, is through spiral, beveled gears which adds to the strength, durability, smoothness and quiet. A 54-

inch semi-elliptic rear spring makes it *ride* like the higher priced cars which have extra long wheelbase.

And yet these are only a *few* of the features that make this car stand out above all competition.

\$19,000,000 Resources and Facilities

But everything else being *equal*, this car would stand out, for it is backed by a great manufacturing concern with \$19,000,000 paid-up capital. And that means *the Stephens Six is permanent*—a car you can sell, and buyers can *buy*, without fear of its being discontinued.

But a concern with such *resources* and *facilities* can give more value *in the car itself*.

So the Stephens Six is not only *better backed* than most others, but is also *better built*.

It is *around* such a car that automobile agents can build a better, *sounder business*. If you are interested, write for all the facts.

The price of the Stephens Six is \$1125, free on board factory, Freeport, Ill.

STEPHENS MOTOR BRANCH

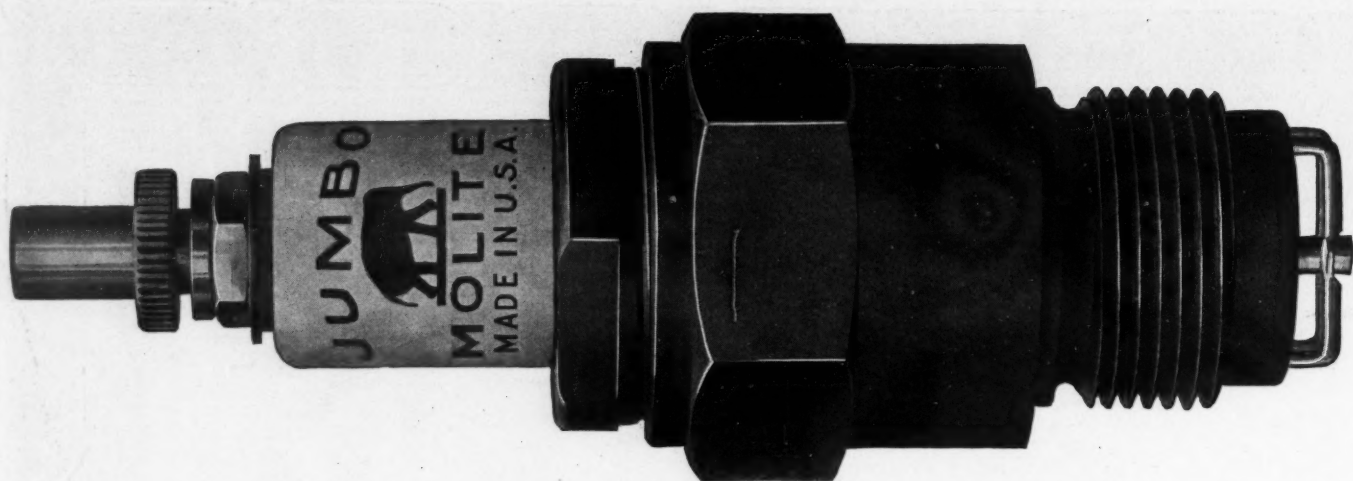
OF MOLINE PLOW COMPANY

Paid-up Capital, \$19,000,000

Address Sales Office, Moline, Ill.

JUMBO SPARK PLUGS

for the motorist



Perfect ignition doesn't mean simply "hitting on all cylinders"—it means a lightning-hot flame that spurts into the heart of the explosive charge and wrings the ultimate ounce of work from every atom of the gas. It means pep—vim—bounce—ginger. It means all the power that the designer meant the motor to have.

It means a quick-as-a-wink pickup when the traffic officer waves you ahead—it means a motor that breathes evenly and smoothly as your car creeps through the congested downtown traffic—it means just the smooth, low humming purr of resistanceless power as you swing up over those last few steepest yards of the neighborhood's worst hill.

In short, it means the sort of ignition service which is definitely and positively assured by Jumbo design and Jumbo construction—service that we could not improve even though we built Jumbo plugs of solid gold.

Your dealer has the type and size best fitted for your particular motor. Why not consult with him today?

69-39

When Writing to Advertisers, Please Mention Motor Age

—and for the dealer

We intend that the dealer who handles Jumbo Spark Plugs shall be a good man to do business with. We place at his disposal every possible selling aid—our aggressive advertising campaigns have impressed the Jumbo name and trade-mark firmly in the minds of car owners—but we do not stop there—

This Handsome Ten-Color Hanger Is Only One

of the selling helps which we have ready for the assistance of the dealer. Transparent window signs, display stands and sample cases for the counter and show case, descriptive folders and large display boxes for use in the window are all at the disposal of the live dealer who cares enough for them

to ask. More than that, he who wants it can have assistance in making up his window displays—either from his own jobber or direct from us. We want every Jumbo dealer to know that we stand squarely back of him, not only in the quality of our plugs, but in the quality of our dealer service.

Gibson-Hollister Mfg. Co.

3380 Washington Street
Jamaica Plain Mass.

JUMBO SPARK PLUGS

DISTRIBUTORS:

Blacklock-Posner Tire Repair Co., 429 South Twentieth St., Birmingham, Ala.; Bailey-Drake Company, 148 New Montgomery St., San Francisco, Cal.; C. H. H. Co., 19th St. at Broadway, Denver, Colo.; Blackstone Sales Co., Inc., 314 Pearl St., Hartford, Conn.; Wadsworth Sales Co., Inc., 6 West Harris St., Atlanta, Ga.; Wadsworth Sales Co., Inc., 1402 S. Michigan Ave., Chicago, Ill.; Hoyt Sales Company, 803 W. Main Building, Indianapolis, Ind.; The Liberty Oil Co., Cor. S. E. 6th & Elm Sts., Des Moines, Ia.; A. F. Wolke Rubber Co., 624 South Third Ave., Louisville, Ky.; W. F. & B. J. Harrison, Inc., 228 Madison St., Springfield, Mass.; Prismatic Lens Co., Osgood Bradley Bldg., Worcester, Mass.; The Auto Tire Rubber Co., 1106 Harmon Pl., Minneapolis, Minn.; Weldon Sales Company, 4137 Holmes Street, Kansas City, Mo.; Auto Devices Company, 3212 Locust Street, St. Louis, Mo.; The Melnhard Auto Sup. Co., 846 Main Street, Buffalo, N. Y.; Asch & Company, 1779 Broadway, New York City; J. Edward St. Louis, 1000 Third St., St. Paul, Minn.; J. O. Dosch & Company, Panama Building, Portland, Ore.; Auto Specialties Co., 6103 Jenkins Arcade, Pittsburgh, Pa.; J. E. Chumbley & Co., 1008 Stahlman Bldg., Nashville, Tenn.; The Ross Rubber Co., 322 Texas St., El Paso, Tex.; Guarantee Tire & Rubber Co., 429 South Main St., Salt Lake City; W. A. Wright's Garage, Cor. R. R. & Portland St., St. Johnsbury, Vt.

CANADIAN DISTRIBUTORS: The Northern Electric Co., Ltd., Montreal, Halifax, Toronto, Winnipeg, Calgary, Regina, Vancouver, Victoria.

JUMBO SPARK PLUGS

ESPECIALLY CONSTRUCTED FOR
HIGHEST SPEED HIGH COMPRESSION MOTORS
ASHORE, AFLOAT AND IN THE AIR

OUR GUARANTEE
ACTION-SATISFACTION-
REPLACEMENT-
OR YOUR MONEY BACK
GIBSON-HOLLISTER MFG. CO.
BOSTON - MASS.

Jumbo Junior
Jumbo First
Jumbo Middle
Jumbo Ford
Jumbo Motorcycle

When Writing to Advertisers, Please Mention Motor Age



The New 1917 Models

Last spring we adopted the double-cowled body on the Moon Six-44. So quickly did it find favor with both dealers and owners, that we have selected this design for the new 1917 models—the Six-66 and the Six-43. In addition to this feature, the 1917 body design (Delauney-Belleville type) exhibits still further refinement. Speed and power are expressed by its long, straight lines—and this impression is heightened by the smart, slanting windshield.

(We venture a prediction: So well has this design been received by the public that we believe by the end of 1917 every car of any moment will have followed our lead in the adoption of this double-cowled body.)

Moon 1917 models will challenge attention and admiration in any company and under any conditions.

But we have not stopped with the improvement of the body design. You will see in this further list of the principal 1917 features many other reasons for Moon desirableness.

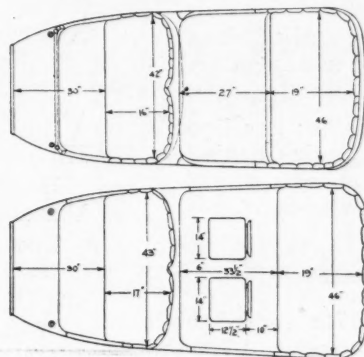
Six-43

Actual Brake Horsepower

AND

Six-66

Actual Brake Horsepower



MOTOR—New Continental-Moon high-speed efficiency type, developing, in the Six-66, full 66 horsepower (actual brake test). The Six-43 develops 43 horsepower (actual brake test). In each case tremendous power in proportion to its weight.

STARTING, ETC.—New two-unit Delco-Moon starting, lighting and ignition system. Bendix automatic drive in connection with starting motor.

UPHOLSTERY—Genuine tan Spanish leather, adding both to the beauty and the comfort of the car.

BODY—Delauney-Belleville type, with double cowl and slanting windshield. Big and roomy (Moon cars have always been noted for their roominess in both front and rear compartments). The seats are especially designed to *fit and rest the body*. The Six-43 body is not quite so long as the Six-66, as space is not needed for the extra seats.

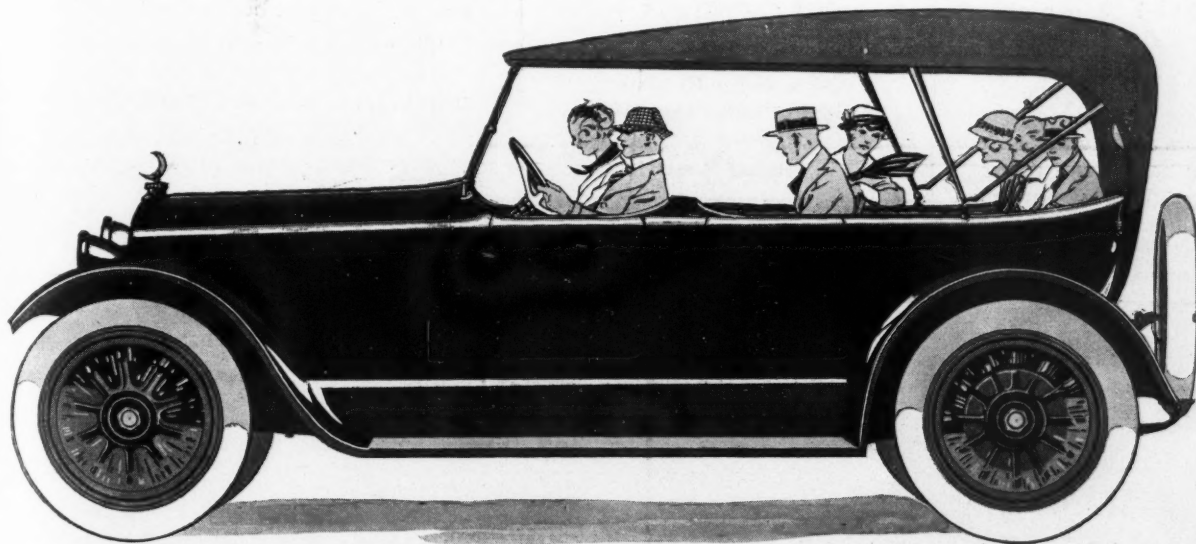
REAR AXLE—Of course the spiral gear *noiseless* rear axle.

WHEELBASE—On the Six-66, 125 inches; and on the Six-43, 118 inches. It will be readily seen from this that these are *big sixes*—as big or bigger than many other sixes selling \$500 to \$600 more.

PRICE—Six-66, seven passenger, fully equipped, \$1575; Six-43, five passenger, fully equipped, \$1250.

MOON MOTOR CAR COMPANY,

St. Louis, Mo.



26 Extra
Features

Mitchell

MID-YEAR
MODEL

\$1325
F. o. b. Racine

John W. Bate's Surprise

To Motordom in general, this latest Mitchell came as a great surprise. And the place it has gained is amazing.

The efficiency which this car typifies has been a slow result. John W. Bate, the genius behind it, has done his work in quiet. And the facts you know now were never told until his work was done.

His 17th Model

The Mid-Year Mitchell is the 17th model built under Mr. Bate. It represents the result of 700 improvements.

The Mitchell factory is a John W. Bate creation. Its 2092 up-to-date machines are all of his design or selection. But this model plant, covering 45 acres, is a many-year development.

So what seems now a sudden result has been really a slow evolution.

The Right Basis

What we have aimed at is to get the right basis. We have aimed to build a high-grade car for less than anyone else could build it.

We now have the plant to do that. Here we build 98 per cent of the Mitchell under Bate efficiency methods. And no other plant in existence can build a similar car at our cost.

The result shows clearly in extra value. In a price below any other car of like size, grade and power.

And in 26 costly extras which other cars omit.

A Lifetime Car

But Mr. Bate's efficiency doesn't stop with that. He has stood for a lifetime car.

He insists on big margins of safety, on Chrome-Vanadium steel, and for oversize parts to meet strains.

The New Mitchell has hardly a casting. But 440 parts are either drop forged or stamped from toughened steel.

There are six Bate-built cars which have averaged 164,372 miles each, or over 30 years of ordinary service.

Extra Attractions

He has also stood for extra attractions. Before completing this Mid-Year Mitchell he had experts examine 257 Show models. Then he combined in this single car all the best of the new conceptions.

He has made the Mitchell the most complete car on exhibit. It has 26 features which rival cars lack.

Now we are making these facts known to every motor car buyer. This season alone we spend \$500,000 in national advertising.

The demand for the Mitchell has trebled in one year. And the facts behind it are just becoming known.

There are still many chances for dealers who deserve such an opportunity. And we want to hear from them.

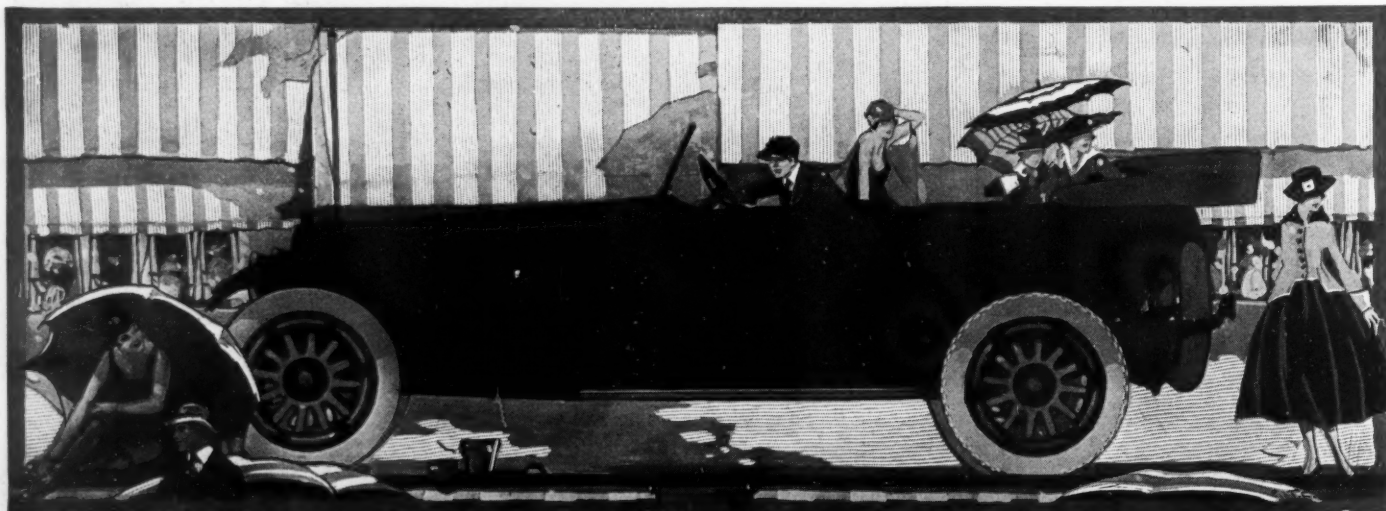
MITCHELL-LEWIS MOTOR CO.
Racine, Wis., U. S. A.

\$1325 F. o. b.
Racine

For 5-Passenger Touring Car or
3-Passenger Roadster

7-Passenger Touring Body \$35 Extra

High-speed economical Six. 48 horsepower; 127-inch wheelbase; complete equipment, including 26 extra features.



When Writing to Advertisers, Please Mention Motor Age



THE Master Carbureter is an Engineering Achievement—

It is based upon a sound scientific principle and has been developed to a degree of efficiency never before attained in Carbureter practice.

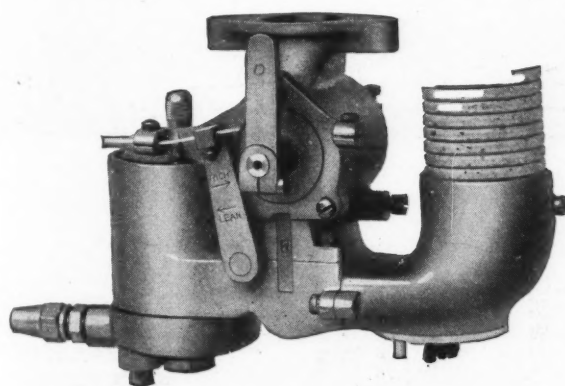
The Master Distributor, for instance, breaks up the fuel so thoroughly that vaporization is instantaneous and complete.

The Master Control enables the driver to regulate the mixture as easily as he adjusts the spark—thus insuring perfect combustion at all speeds and under all sorts of weather conditions.

And these two features—complete vaporization and correct mixture—justify the Master slogan—"More Miles Per Gallon, More Power, More Speed."

A demonstration on your own car will quickly convert you to the Master principle.

The Master Carbureter Corporation
Detroit, Michigan

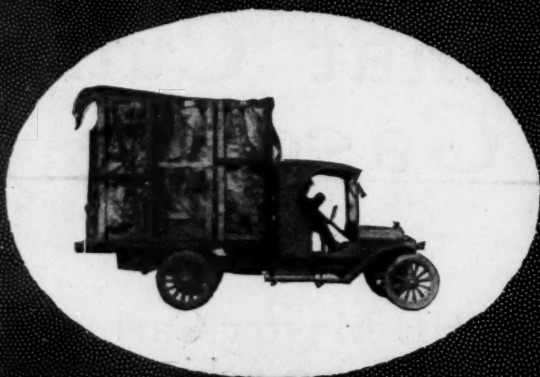


Pacific Coast Branch
Master Carbureter Corporation
922-24 So. Los Angeles St.
Los Angeles, Cal.

SIMPL

Study the illustration at the bottom of the page. Note the absolute simplicity of the AMES-TON Worm Drive Truck Unit for Ford cars, by means of which anyone can transform a Ford car into a one-ton truck in 30 minutes' time. Note particularly that with the AMES-TON it is not necessary to make a jackshaft out of the rear axle.

You will observe that the frame of the Ford car becomes a sub-frame in connection with the AMES-TON unit, through the use of only four



Ames
Worm Drive Truck

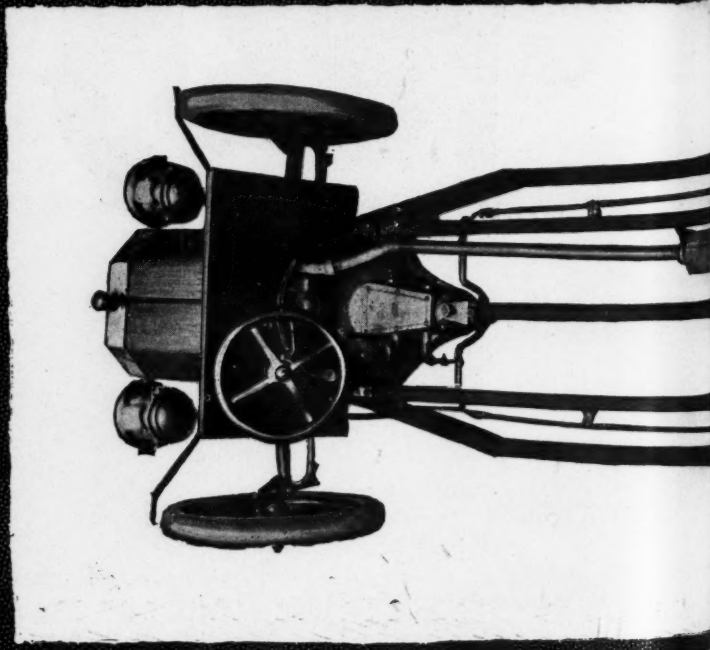
rivets on each side. Take note of the fact that the rear end of the Ford frame becomes an additional cross member for the AMES-TON unit. Note how the AMES-TON propeller shaft is connected with the chassis of the Ford through use of only a universal joint.

Consider that the AMES-TON is not only simply constructed and simple to attach, but also most simple to operate.

The F. A. Ames Company, Inc.

\$395
f.o.b. Owensboro

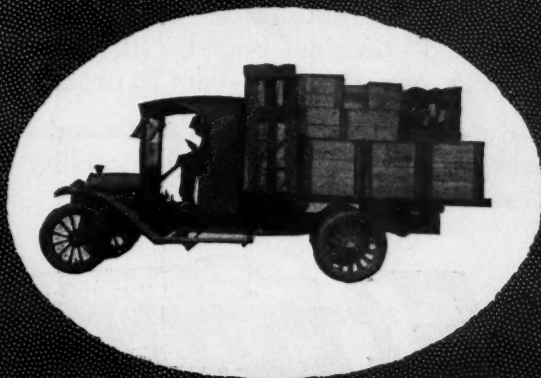
**PATENT
APPLIED
FOR**



ICITY

The absence of any complication whatsoever makes it an extremely easy matter to care for the AMES-TON. AMES-TON is absolutely fool-proof. It cannot go wrong. Anyone of normal intelligence can attach the AMES-TON without the use of any other tools than two hands and a monkey wrench.

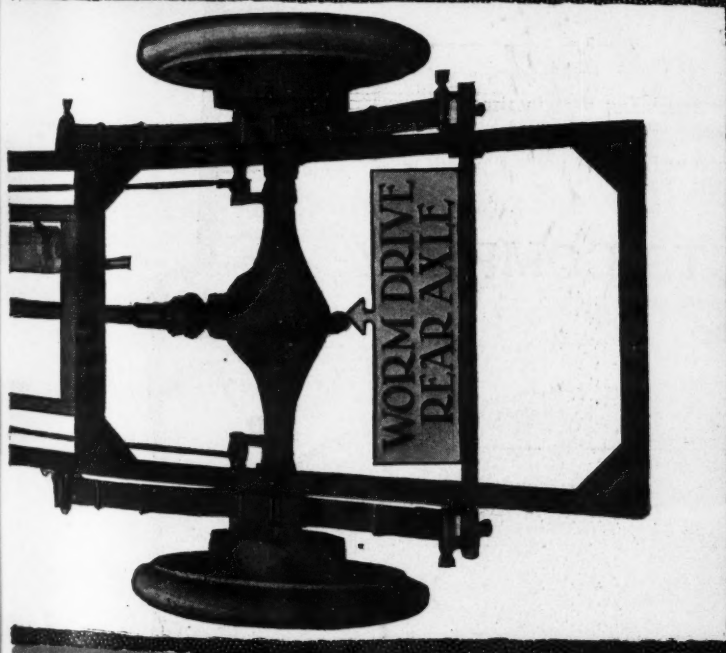
The constructional simplicity of the AMES-TON ensures minimum operation expense and the avoidance of frequent and costly repairs.



AMES-TON
Unit For Fords

DEALERS—AMES-TON—the only worm drive truck unit—has already established itself as the leader in its field. AMES-TON Dealers are getting the cream of the business. Competition cannot touch them. We have a special offer for a limited number of new dealers who get in touch with us at once. Wire or write today.

Owensboro, Kentucky



*Simplest to Attach
Simplest to Take
Care of*

**DEALERS
WIRE or
WRITE**

Fortify Yourself with "Strongholds"

YOU get thousands of excess miles out of "Stronghold" tires because we build thousands of excess miles into them at the factory. "Stronghold" tires are built by hand, under the personal supervision of experts trained for 18 years in producing wear-resisting rubber.

And they are cured under an improved process that has no equal for preserving all the strength and durability of which high grade rubber and fabric are capable.

Stronghold **TIRES & TUBES**

"Stronghold" tires are liberally guaranteed by us, and sold only by Dealers who are thoroughly Reliable, and equipped to give you the best attention and service.

Try just one "Stronghold" next time—the other three will follow in due time.

Tire Dealers

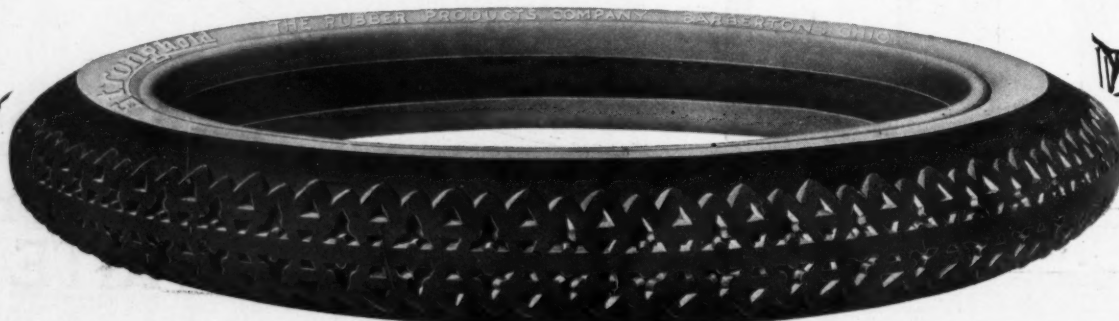
"Stronghold" tires and tubes are making good everywhere. Put them on the cars of a few of your Best Customers and compare results. Fortify yourself by taking on this specially good tire and going after the trade of car owners who demand The Best in tire service.

Write for open territory and our proposition
of Exclusive Sale and Distributor Prices

THE RUBBER PRODUCTS COMPANY

18 years of experience in making wear-resisting rubber

BARBERTON, OHIO



When Writing to Advertisers, Please Mention Motor Age



The Secret of "Small Up-keep" is Perfect Lubrication

The first cost of an automobile is important, but what does it cost you to run it? That's more important. Is your car laid up frequently—scored cylinders—burned out bearings—smoky spark plugs?

Use **Polarine**
FRICTION REDUCING MOTOR OIL

A perfect lubricant that covers even the remotest friction surface, protecting every wearing part and reducing friction to the minimum. Friction minimized means repairs minimized and increased power as well.

Polarine flows freely at zero and maintains the correct lubricating body at any motor speed or temperature.

Order a half barrel today. It's cheaper that way than in smaller quantities.

Standard Oil Company (Indiana) Chicago, U. S. A.

Use Red Crown Gasoline and get more power, more speed, more miles per gallon

14a

Speedway Type

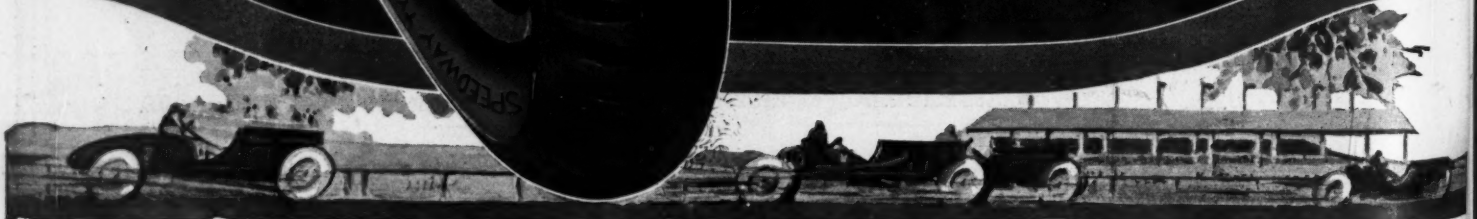
Smooth Riding Non-Skid
Double Tread—Double Wear

In this new type tire you have a double wearing tread—two treads in one—that deliver almost double mileage.

Not alone that this new type of scientific non-skid is as *smooth-riding* as a plain tread. "Inside fabric wear," such as develops in most non-skids is impossible in this tire because of its continuous unbroken contact with the road.

National
REDWALL
Speedway Type
TIRES

30x3	Non-Skid	\$12.05
30x3½	Non-Skid	\$15.60
32x3½	Non-Skid	\$17.95
33x4	Non-Skid	\$25.65
34x4	Non-Skid	\$26.20
36x4½	Non-Skid	\$36.95



When Writing to Advertisers, Please Mention Motor Age

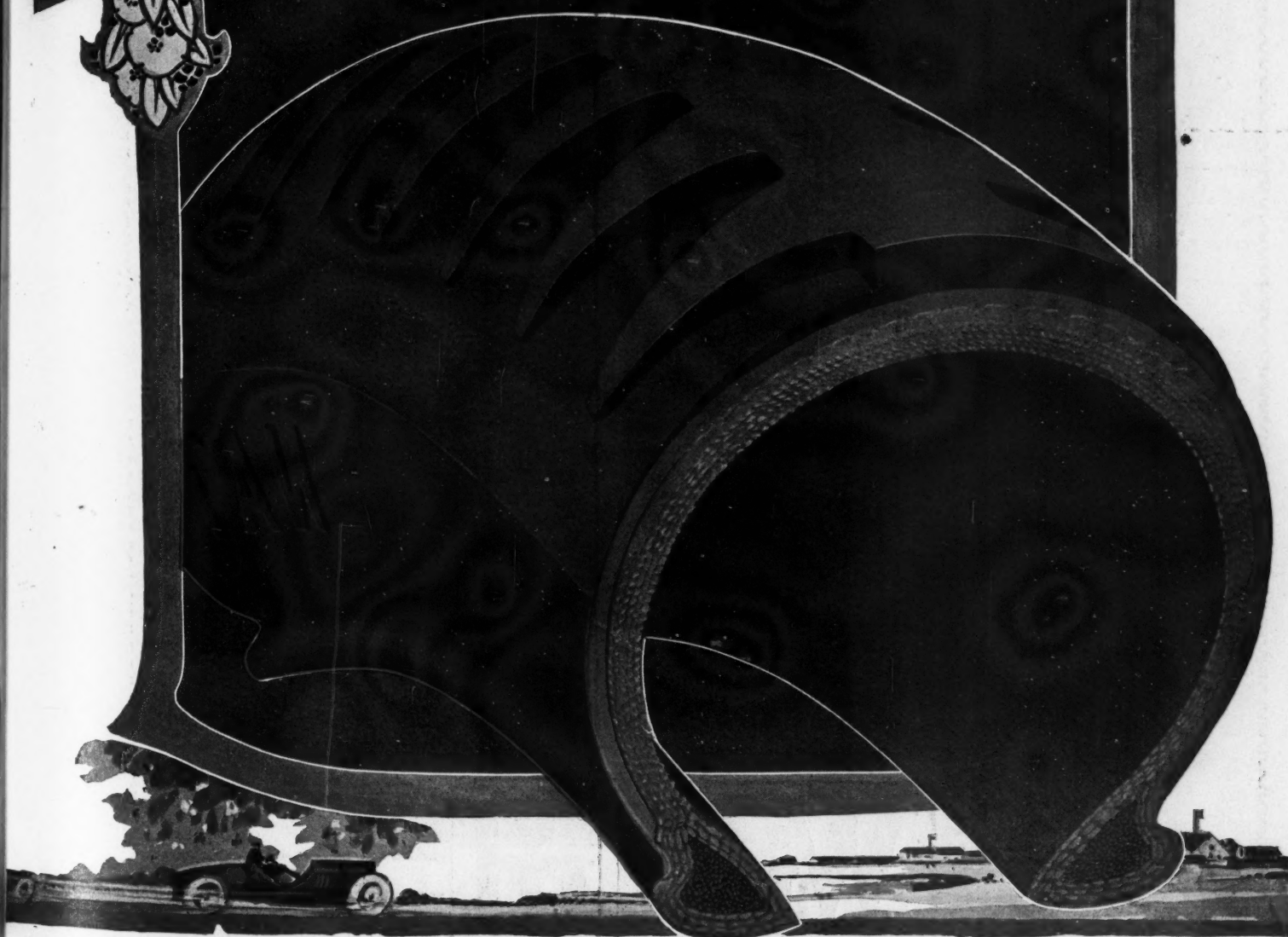
From first to last superior in design, construction, material, workmanship, supervision *and satisfaction.*

Point for point, no better tires are built. Made in non-skid only. Guaranteed for 4000 miles.

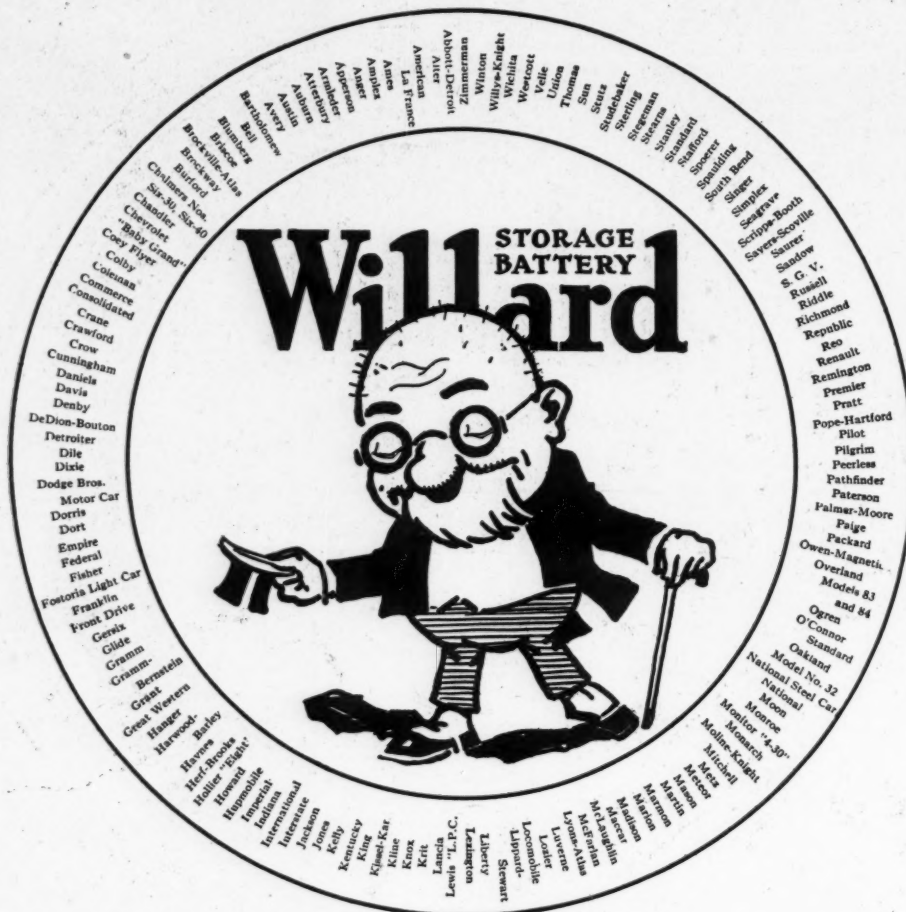
National Rubber Company

Pottstown, Penna.

Dealers and Jobbers, write for particulars regarding exclusive territory, discounts, etc.



When Writing to Advertisers, Please Mention Motor Age



The Center of Attraction

It's perfectly natural that over 150 car builders should merely say "Willard" and forget battery problems.

By doing so they accomplish three things.

Most important of all, they add to the salability of their car by assuring the owner of a reliable battery.

They lessen their own service responsibility by relying on 800 Willard Service Stations, every one in charge of an expert.

And finally, they make it easy for the car owner by affording him the battery helps which the name Willard implies—free inspection, advice, literature on care, and expert attention.

Booklets R-9 and R-10 go into more detail. Write for them—they're free.

Willard Storage Battery Company

Cleveland, Ohio

New York: 228-230 W. 58th St.

Chicago: 2524-30 So. Wabash Ave.

Atlanta, Ga.: 8-10 East Cain St.

Indianapolis: 316-318 N. Illinois St.

Detroit: 736-38-40 Woodward Ave.

San Francisco: 1433 Bush St.

Minneapolis: 36-38-40 So. 10th St.

Direct Factory Representatives in Philadelphia, Boston, Dallas, Kansas City, Omaha and Seattle.

Service Stations in All Principal Cities in the United States and Canada.



When Writing to Advertisers, Please Mention Motor Age



"One of the Five Best Trucks Built in America"

Get Your Money's Worth

DO you know what makes the engine, drive shaft and transmission independent of the main frame? What relieves these vital working parts from strains, twists, distortions and weave of the frame? What saves wear and tear on the engine? What prevents friction and saves fuel? What provides more power delivered to the rear wheels? What avoids troubles that put trucks in the repair shop? What allows the engine to do more work and to live longer? What keeps the truck in service and on the job? What saves the engine from being worn out by internal troubles and conserves all its service for actual pulling on the roads?

The answer for ALL these questions can be found in one and ONLY ONE TRUCK—the U. S.

How can you get the MOST FOR YOUR MONEY unless your truck provides all of these money-saving and money-making qualities?

Let us go more into detail and explain our EXCLUSIVE floating power plant; explain why it is mathematically certain that you are guaranteed greater returns out of your investment in the U. S. Truck; explain why the U. S. Truck dealer proposition is the best.

Seven years success. Established in 1909.



The United States Motor Truck Co., Cincinnati, O., U.S.A.

When Writing to Advertisers, Please Mention Motor Age

BAUSH

WORM DRIVE



Furnished in either the straight face or hour glass type.

Worm surfaces accurate to within one - ten - thousandth of an inch.

From 1% in 1913 to more than 50% in 1916

These figures show graphically the acceptance of the worm gear type of final drive by the truck users of this country. Abroad worm gear was the dominant type of drive even before 1913 and today is accepted as practically the standard type of drive.

Since 1913, when worm drives were given their first serious consideration in this country, this type of drive has steadily grown in popularity until more than half of all the trucks produced for 1916 will use worm gear driven rear axles.

This dominance of worm gears is due solely to the greater efficiency of the worm gear type of drive judged from any standpoint. The average life of a worm gear is exceedingly high—it improves with use—it is extremely quiet in operation and requires little or no attention during its entire life.

Baush Machine Tool Company
SPRINGFIELD, MASS.

Manufacturers also of Multiple Spindle Drills,
Lassiter Stay Bolt and Bolt Turning Machines.



When Writing to Advertisers, Please Mention Motor Age



OpcO

completely routs this enemy, and if consistently used will keep your engine free of carbon and proof against its attacks.

OpcO is an oil—not a chemical. To apply it you simply warm up your motor, remove spark plugs and pour into each cylinder about 2 ounces of OpcO Carbon Remover, let it set for 5 minutes—then start your motor again and watch carbon and dirt fly out of the exhaust in heavy smoke.

WE GUARANTEE THIS. If OpcO is used according to directions and fails to make good our claims, you may return the can and we will refund your money.

OpcO has been TESTED AND ENDORSED BY LEADING ENGINEER AUTHORITIES, Car Manufacturers, and over 35,000 users throughout the country, as the most effective method of removing carbon from cylinders.

We have an enormous number of testimonials on file, from a few of which the following extracts are taken:

Bulck Motor Co. (C. B. Durham, Mgr. Factory No. 1):

"We tried this out on a car badly fouled up with carbon. It removed it clean as a whistle. Of all compounds I have seen tried, this is the best, and I am going to keep a can for my car from now on."

Sterling Motor Co. (W. H. Little, Mgr.):

"The valves in my car were badly clogged with carbon. I put some of your OpcO Carbon Remover in and the improvement was most marked. I am instructing our Purchase Department to place an order with you for some of this Remover in order that we may have it on hand at all times."

Chevrolet Motor Co. (H. C. Dunning, Production Mgr.):

"Regarding the try out of your OpcO Carbon Remover, as the writer is very familiar with these try outs and experiments with this Remover, I wish to state that our tests have proved to be entirely satisfactory."

Peerless Motor Car Co. (R. J. Schmunk):

"We applied the OpcO, and the improvement noted was, to say the least, wonderful. * * * It not only simplifies the removal of carbon from cylinders, but reduces the expense to a point that should make it extremely attractive."

If your dealer does not have OpcO, send us his name and \$1.00, and we will see that you are promptly supplied.

Dealers: Many dealers are getting lots of new customers through handling OpcO. Let us send you interesting particulars.

American Oil Products Co.

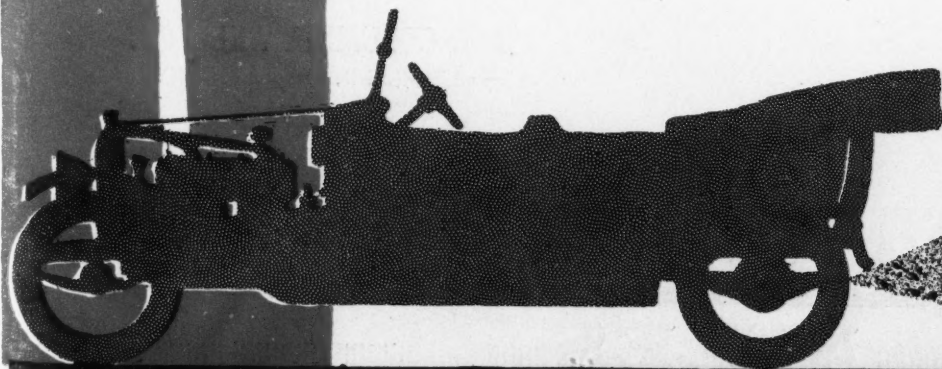
1426-38 Seneca Street

Buffalo, N. Y.

U. S. A.

IN
GOES
OpcO

OUT GOES
CARBON



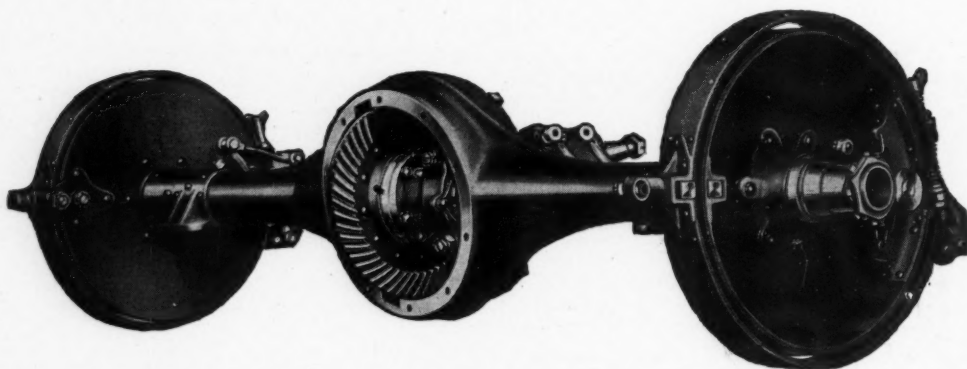


FREEDOM

It is the firm purpose and resolve of each workman in our organization that Columbia Axles shall go into use free from error or defect in construction.

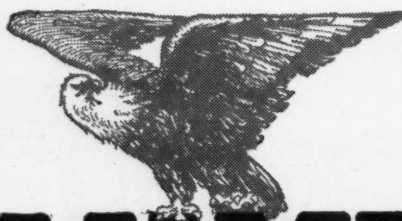
It is this spirit expressed in the terms of service given by Columbia Axles that contributes so largely to the enjoyment and pride of owners in whose cars Columbia Axles are incorporated.

Freedom from racking axle noises; freedom from danger of breakage; freedom from the annoyance of frequent adjustments; all serve to enhance greatly the enjoyment of motoring and motor car ownership.



Columbia Rear Axles are three-quarter floating-type construction. The brakes are correctly designed, large and powerful. Spiral Bevel Gears assure quiet operation with the highest efficiency in the transmission of power.

A booklet interestingly describing the making of Columbia Axles will be gladly sent on request. A copy will prove of real value to any automobile Dealer, Owner or Repairman.



THE COLUMBIA AXLE CO.
CLEVELAND, OHIO



COLUMBIA

AXLES



When Writing to Advertisers, Please Mention Motor Age



DODGE BROTHERS ROADSTER

When people speak of the car they
invariably speak of its quality.

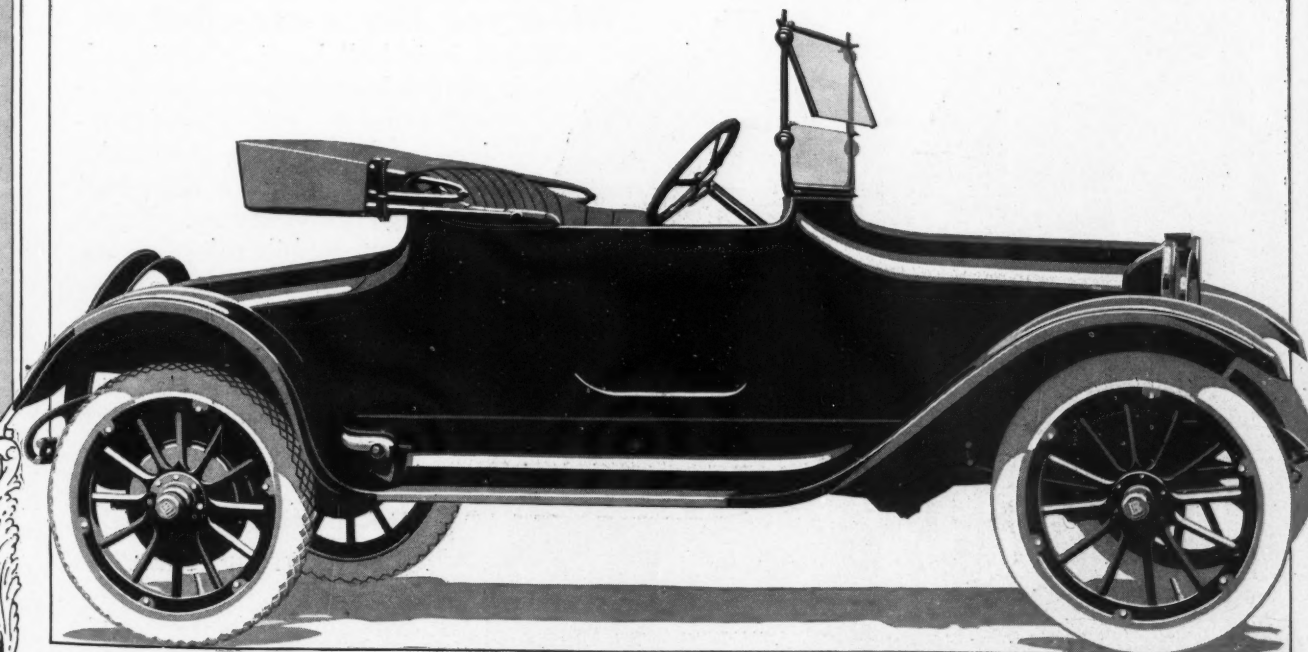
This is something outside and above and
beyond salesmanship and advertising. It is
a spontaneous force at work which is greater
than both.

The gasoline consumption is unusually low
The tire mileage is unusually high

The price of the Touring Car or Roadster complete
is \$785 (f. o. b. Detroit)

Canadian price \$1100 (add freight from Detroit)

DODGE BROTHERS, DETROIT



SKF BALL BEARINGS

Kill It Don't Muffle the Noise!

Transmissions, no matter how well made, unless they are properly "bearinged" wear rapidly and run noisy. This is because the original setting of the gears becomes disturbed by the bearings wearing down or because of the binding action of deflected shafts.

S.K.F. Ball Bearings kill friction and noise. They do not require adjustment. Why?—because

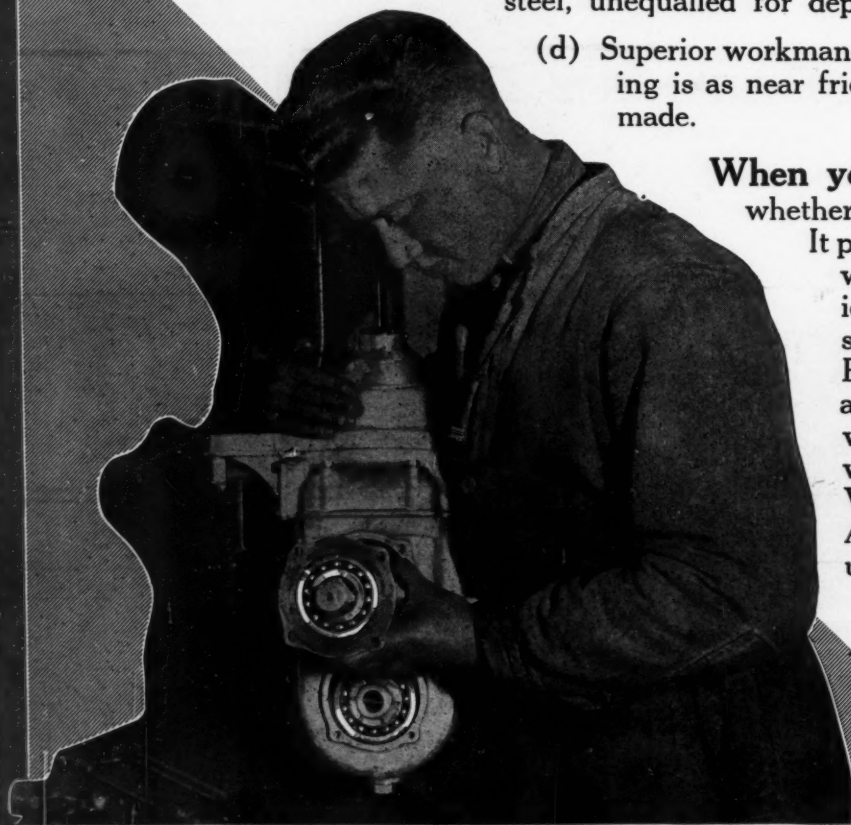
- (a) Each S.K.F. has a double row of balls providing extra carrying capacity and greater safety.
- (b) The construction is such that there can be no binding strains in the bearing. Driving in intermediate, the jolts and shocks of hard service cannot cramp or wedge the balls. Both rows of balls carry the load.
- (c) The Balls and Races are made of Swedish crucible steel, unequalled for dependability and hard service.
- (d) Superior workmanship and accuracy. The bearing is as near frictionless as a bearing can be made.

When you buy a car—find out whether it is ball bearing equipped.

It pays to know whether your car will stand the gaff of hard service—and one way to make sure is to look for S.K.F. Ball Bearing equipped cars. If you are an automobile salesman we will be glad to provide you with a new sales argument. Write for "Ball Bearings as an Automobile Sales Factor," using your business letterhead.

SKF BALL BEARING CO.
HARTFORD, CONN.

6-29-16 Motor Age



\$1000 CHALLENGE

To Any and All Auxiliary Air Devices Now on the Market

We hereby issue an unqualified Challenge to any maker of an auxiliary air device with claims as to Speed, Power and Mileage, similar to ours, to a test of merit under actual driving conditions—on the steepest

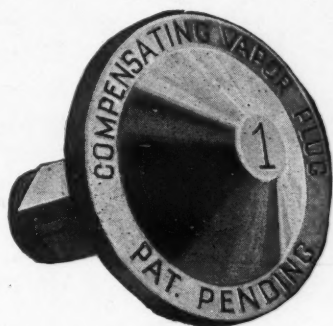
hills—over the most rugged roads—in the deepest sand, to determine once and for all whether any auxiliary air device is capable of equaling or surpassing the proved savings of the

Compensating Vapor Plug

which gives

30% More Speed
30% More Power
40% More Mileage
Less Carbon

You can attach in 5 minutes.
Fits any car—never wears out.



\$5

Parcel Post
Paid

Money Back
in 30 days
if not
satisfied

**Simply tap hole in Manifold
and screw in the Plug.**

—OR YOUR MONEY BACK—

The only condition is that only one adjustment of carburetor shall be made—no separate adjustment for speed—no separate adjustment for power—no separate adjustment for mileage—only one adjustment to show all three

Make Your Own Tests at OUR Risk—On Your Own Car—In Your Own Way

You are not interested in boulevard or flat road tests—no matter how official they may be. What you want to know is what you can expect under the usual conditions of driving your own car over all kinds of roads, in all kinds of weather. The COMPENSATING VAPOR PLUG has already passed through the most severe tests of skilled engineers, under adverse conditions—over the roughest and hilliest by-ways in Michigan through mud and sand and produced an even bigger percentage of increase in speed, power and mileage, than we claim for it.

But we are not asking you to buy the COMPENSATING VAPOR PLUG on the strength of any test except your own. We are taking away every element of chance by offering to refund your money at any time within 30 days of your purchase.

If our claims were not cold facts, we could not afford to make this great "show me" offer. You can't say, "Well, it might be a good thing for some cars, but not for mine," because we

These USERS Prove Our Claims—Read Their Letters—Thousands More Like Them in Our Files

Pronounces It O. K.
Detroit, Mich.

On a straightaway drive over country roads I covered 32 miles on three-quarters of a gallon of gasoline. But the thing that impresses me most is the increased flexibility—slowing down to three miles an hour, and picking up without an effort, and with no fear of stalling. That of itself makes the device worth while.
LEN G. SHAW.

Results Exceed Claims

I find that the results exceed your claims in the flexibility of the motor, mileage per gallon of gasoline and power.
H. M. POWER.

Here's Real Economy

St. Johns, Portland, Ore.
It increased our mileage nine and one-half miles per gallon gasoline.
WHITNEY ROSE.

factors. Any manufacturer of an auxiliary air device who does not accept this Challenge at once has not confidence in his own device and therefore is not entitled to the confidence of the public.

guarantee you that it will produce at least 30% more speed, 30% more power and 40% more mileage, for any car if the motor is in good condition. It gets at the very things that make your old car out of date—lack of speed—lessened power—higher gasoline consumption. It makes the liveliest new car livelier.

The COMPENSATING VAPOR PLUG is not of the "all-day sucker" type—nor of the complicated type that strangles your motor with a mass of tubing and piping. It is simple to install and just as easy to take off and remember that the COMPENSATING VAPOR PLUG is patented and protected and that all similar devices are infringements. Why buy a possible law suit from an unprotected imitator, when you can get the COMPENSATING VAPOR PLUG just as easily?

We have sold 600,000 VAPOR PLUGS to dealers who know things that work when they see them and won't buy anything else. Our business is growing by leaps and bounds, because we can guarantee things that are just as true as they are sensational.

34½ Miles Per Gallon

On an official test in this city I ran 34.5 miles on one gallon of gasoline, and have been averaging about thirty miles to the gallon during winter months.
H. J. HANEY, Mgr.
Gas Appliance Co.

Measured Gallon

Have given the plug a fair trial, one gallon of gas in the car without the plug

giving 16 miles per gallon and one gallon of gas in the car with the plug making 28 miles per gallon.

DELTA AUTO CO.

Expects Even More

The first trial gave me thirty miles to the gallon, where I formerly had only 15 to 16. After proper adjustment of carburetor, I expect to do even better.
W. A. ORLAMOND,
Technical Dir., Gaumont Co.

Wanted—Dealers

The Compensating Vapor Plug sells like wildfire to every car owner. Exclusive contracts. We back you with big national advertising. Prove to us that you are a live one and we do the rest. This wire from Milwaukee: "Will take all Plugs your Factory can possibly turn out during the next 24 hours. Ship 500 assorted sizes today.—Signed, Evans & Son." This letter from a car owner: "I enclose herewith a check for \$50.00, for which please send me 10 of your Compensating Vapor Plugs for the following cars—Peerless 60; Peerless 48; Packard 48; Renault 35; Chevrolet Baby Grand; Stewart Truck, and Federal Two-Ton Truck." Write, wire, phone or jump the first train for Chicago—get this fastest selling accessory—a money-saver for any car owner and a money-maker for you.

You Want this Money Saver for Your Car

Accept this money-back offer right now. The price is \$5.00—send us the coupon with a \$5.00 check, P. O. or Express Money Order attached—as a deposit until you are more than satisfied. \$7.00 in Canada. If, after a 30-day trial, you decide you can do without the COMPENSATING VAPOR PLUG, send it back and we will return your \$5.00. No matter how hard-headed a buyer you are, you have never been offered a fairer or more liberal proposition, so Tear Off The Coupon—Mail It Now—Today.

AUTOMATIC CARBURETOR CO.

2017 Michigan Avenue, Chicago, Illinois

Makers of Famous Automatic Carburetors

Specialists in Gasoline Devices for Motors

Canadian Distributing Co., 125 Pacific Ave., Winnipeg, Manitoba

AUTOMATIC CARBURETOR CO.
Dept. D, 2017 Michigan Ave., Chicago, Ill.

Enclosed please find \$5 (\$7 in Canada) in full payment for one Compensating Vapor Plug—with the understanding that you guarantee it for life and will refund my deposit in full if I return your device to you, collect, within 30 days.

I use a.....sized carburetor; name of car,

.....model.....year.....

Name.....

Address.....

I recommend as a good dealer.....

.....of.....



"There I Was Cranking My Fool Head Off!"

"I turned the motor over and over, but never a spark. The Old Lady was fuming, and her sewing society friends were laughing behind their fans. After tracing up the wiring and finding it all right, back I went to the old dry cells—I'd never touched them before—and, curse the stupid luck, they'd gone dead on me!

BENFORD'S
Indestructible Storage
Battery Tester

\$1.50

Insures your electric
system's efficiency—
saves time, worry and
expense.

BE SURE!

"A couple of miles from a village, with a stalled car, a cranky missus and a couple of grinning dames on my hands! Nothing to it! I had to do a Dan O'Leary into town; I got half a dozen dry cells, and told the boss of the supply store my troubles. He introduced me to the dandiest little device—it would have saved me a trip, a lot of trouble and some money if I had known of it before—it was a

BENFORD'S INDESTRUCTIBLE DRY BATTERY TESTER

PRICE, \$1.00

"It's a dandy; handy as a fountain pen, you can smash it around and you can't break it—and it will register the condition of your dry cells any time with absolute accuracy.

"It's worth a dollar of any man's money! With the BENFORD AMMETER and an extra cell in my kit I've said 'Good-night' to all ignition trouble—because I take a stitch in time and find the 'dead one' before it can put the other cells out of commission.

"They make a STORAGE BATTERY TESTER, too—the plutocrat with a big car and an honest-to-goodness electric system with a storage battery ought to get one!

"Its price is \$1.50—lots less than the cost of a cuss-word."

Dealers—Thousands of cars owners

← in your locality need these! →

BENFORD MFG. CO.
MT. VERNON, NEW YORK



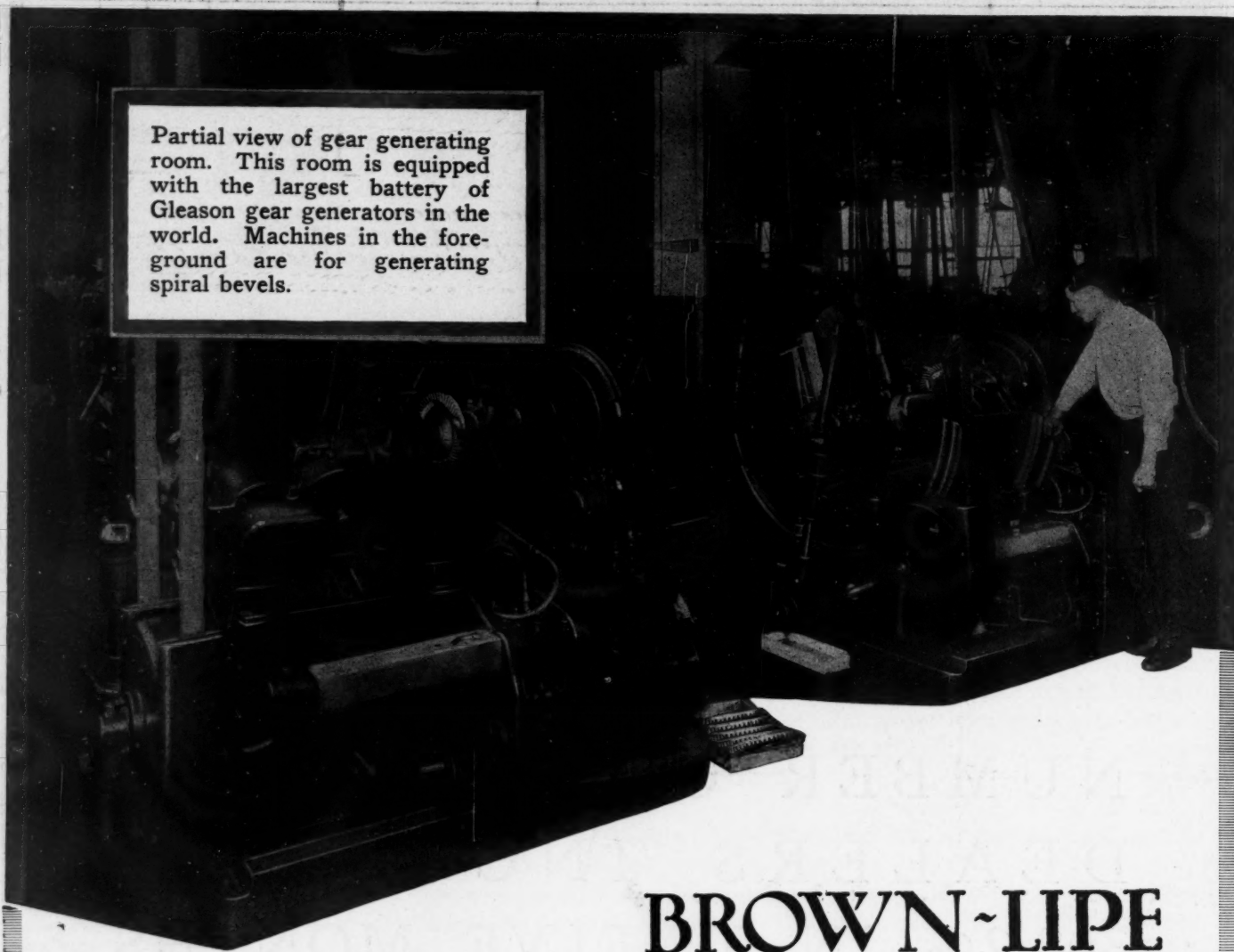


Quality First

NUMBER OF CHALMERS
DEALERS INCREASES
308.2% IN TWELVE MONTHS

On June 1, 1916, there were 1433 Chalmers dealers of record as against 351 on the corresponding date last year.

This shows a net increase of 1080 Chalmers dealers or 308.2% in twelve months.



Partial view of gear generating room. This room is equipped with the largest battery of Gleason gear generators in the world. Machines in the foreground are for generating spiral bevels.

BROWN-LIPE

IT is now a generally accepted fact that the finest gears are those which are generated, rather than those produced by rotary cutting or planing.

This is true, because in generating a gear the cutting is done in such a way as to insure greatest accuracy and finest finish.

The drawback in the past to this method of manufacture has been its slowness, but with the development of the Gleason Generator to its present state of efficiency it is possible to generate bevel gears which combine this extreme accuracy and fine finish with extremely rapid production.

Because of the possibilities offered by use of Gleason Generators in maintaining quality with quantity the Brown-Lipe-Chapin Company has installed in its differential factory the largest battery of Gleason Gear Generators in the world.

BROWN-LIPE GEAR CO. SYRACUSE, N.Y. U.S.A. BROWN-LIPE CHAPIN CO.
Transmissions *Differentials*

NEW YORK
 Thos. J. Wetzel,
 29 West 42d St.

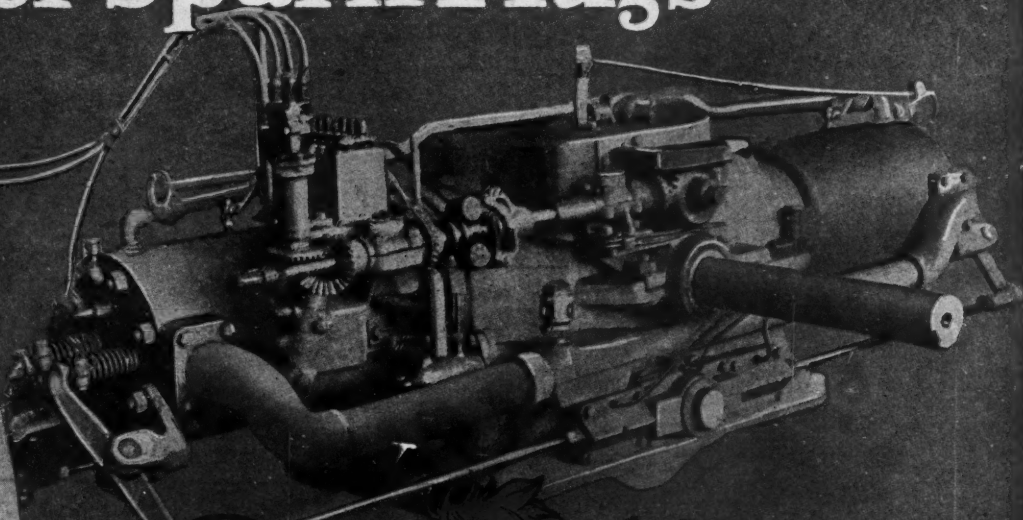
CHICAGO
 K. Franklin Peterson,
 122 So. Michigan Ave.

DETROIT
 L. D. Bolton,
 2215 Dime Savings Bank Bldg.

SAN FRANCISCO
 A. H. Coates, 444 Market St.

Foreign Agent, Benjamin Whittaker, 2, Norfolk Street, Strand, London, W. C.

This Engine is No Playground for Spark Plugs



Red Head
BIG BOY

spark plugs are used as standard equipment, with satisfactory results, in the gigantic 50 H-P engines that drive the powerful motor rollers manufactured by the Kelly-Springfield Road Roller Co.

The road roller smoothens the riding on the highway—the Red Head Big Boy smoothens the running of the motor.

Is your car equipped with Red Heads?

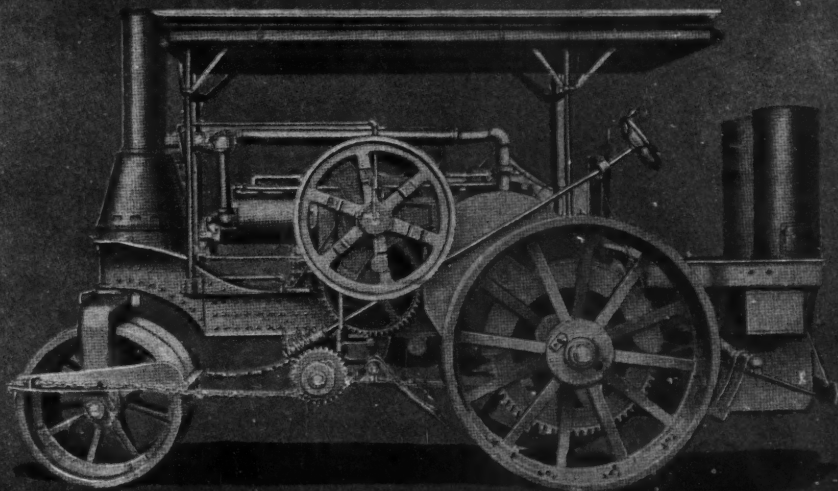
EMIL GROSSMAN M'F'G CO., INC.

Bush Terminal, Model Factory No. 20

41st Street and Second Avenue, Brooklyn (New York City), U. S. A.

Chicago, 1253 Michigan Avenue

3 Points **1** Dollar



How Can You Do It?

That is what Dealers ask when they see the

NEW BLACK TREAD Miller Tire

GEARED TO THE ROAD

And it is no wonder. Here is a tire of typical Miller quality with a tough, black Geared-to-the-Road Tread, selling at

A Standard Price to Meet

a Popular Demand

And more. The Miller plan of selling tires gives the dealer *his*. It gives him a lucrative profit on every tire sold in his territory—not a small profit on a part of the tires sold. That is why the agency for Miller Tires is a valuable asset—a force that you want working for you—not against you.

Made in All
Standard
Sizes
and
Types

The New Miller Tire

the latest addition
to the Miller family,
is the tire surprise of the year. You want to know all about it, of course, how it is made, etc. You know, that the tire itself is right, because it is a Miller, and you want the answer to this question

Size 34x4—price?

Write, or better yet, wire for full particulars about the New Miller Tire. Get an option on the territory you want now before some other live dealer beats you to it.

THE MILLER RUBBER CO., AKRON, U. S. A.

AUTO-LITE **ELECTRIC** **STARTING AND** **LIGHTING** **SYSTEM**

Electric Auto-Lite

STARTING - LIGHTING - IGNITION

Huge Production Means Accuracy

Our huge production makes possible the highest degree of manufacturing efficiency.

It demands the employment of highly skilled labor.

And it permits the use of hundreds of highly specialized machines—designed for our own requirements.

Each machine performs its own particular duty with an accuracy and precision impossible under ordinary methods.

The work is done rapidly, yet each finished piece is an exact duplicate of its fellow.

There is no variation.

And Accuracy Means Efficiency

When thousands of absolutely accurate parts are made up into thousands of Auto-Lite systems, the result is an absolutely uniform dependability of action.

There is no undue strain upon one part because another part is not true.

There is no undue friction caused by moving parts being a thousandth of an inch too large or too small.

All parts "pull together" all the time.

Their accuracy and exactness produce—in the finished article—an efficiency of the very highest type.

The Electric Auto-Lite Company

Home office and factory, Toledo, Ohio

New York

Detroit

Kansas City

San Francisco

Our enlarged factory
contains 400,000 square
feet of floor space.





Carspring BEST UNDER A CAR - BEST ON EARTH Tires

With the Carspring agency you can build an exclusive and permanent business. You will secure the entire profits from your territory.

In many sections of the country "Carspring" distributors are making big profits under our exclusive sales policy. The "Carspring" plan is founded on the same basis as an automobile agency—exclusive territory, liberal working agreement, unlimited co-operation and direct credit for every sale in your territory.

Why sell a half dozen brands in direct competition with other dealers and take small profits, no authority to make satisfactory adjustments or any semblance of business protection to your trade?

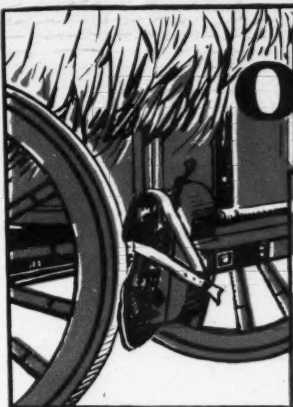
For fifty years New Jersey Carspring rubber products have been first and foremost in their respective fields.

Among men who know tires there is no hesitancy in selecting "Carsprings" for their personal use.

If your territory is open, we have a proposition that will bring you a net profit of one thousand dollars up—each month. A telegram preceding your letter would be good business.

**New Jersey Car Spring
& Rubber Company**

JERSEY CITY
NEW JERSEY



Old Brake Shoes and

Modern Brake Lining

H. W. JOHNS-MANVILLE CO.

EXECUTIVE OFFICES, 296
Madison Ave., New York City

Akron	Memphis
Albany	Milwaukee
Atlanta	Minneapolis
Baltimore	Nashville
Birmingham	Newark
Boston	New Orleans
Buffalo	New York
Chicago	Omaha
Cincinnati	Philadelphia
Cleveland	Pittsburgh
Columbus	Portland
Dallas	Rochester
Dayton	St. Louis
Denver	St. Paul
Detroit	Salt Lake City
Duluth	San Diego
El Paso	San Francisco
Galveston	Seattle
Havana	Syracuse
Houghton	Toronto
Houston	Tulsa
Indianapolis	Washington
Kansas City	Wilkesbarre
Los Angeles	Youngstown
Louisville	

THE CANADIAN H. W.
JOHNS-MANVILLE CO.
LIMITED

Toronto Winnipeg
Montreal Vancouver

The farmer's shoes twenty years ago gave up their last few weeks of wear as a facing for his wagon brake. And they were plenty good enough to stop a 1000-pound cart traveling at 3 miles an hour.

In those days vehicle brakes called for little attention. The big problem was industrial machinery brakes—heavy braking service which Johns-Manville Asbestos Brake Lining met then, as it does today, with safety and long wear.

But when the motor car came, most manufacturers faced a new problem—that of producing a safe, dependable brake lining for vehicles. To Johns-Manville with 20 years' experience in the fabrication of asbestos textiles it was simply a question of adapting a lining of proven safety and wear under the most severe conditions, to this new and lighter service. That is why

Johns-Manville Asbestos Brake Lining

has been able to make and hold an enviable reputation for positive grip, long wear and economical service. Try it.

To the Trade

J-M Asbestos Brake Lining is a profitable article to handle. The same liberal discounts apply on all quantities purchased so there is no need of carrying a big stock. Write nearest Branch at once for full particulars.

Johns—Manville ASBESTOS BRAKE LINING



J-M (Mezger)
Soot-Proof
Spark Plug



J-M Windshield
Attachment for
Ford Cars



J-M Non-
Blinding
Headlight
Lens



J-M Fire
Extinguisher.
\$3.00, Brass
or Nickel
Finish Bracket
included

When Writing to Advertisers, Please Mention Motor Age

The Standard Spark Plug of America

Automobile Advancement Defies All Speed Laws

Pessimists who said "it can't be done" are pushed aside by optimists who are actually "doing it." The AC—the one Standard Spark Plug of America—is an accomplished fact. The Champion Ignition Company, of Flint, Michigan, has made it so.

You may buy plugs which cost but little—you may buy plugs which are really good plugs. But the combining of maximum efficiency at minimum cost in a single plug is such a task that today there is only one single make of plug wherein the feat is actually accomplished. That—

AC Spark Plugs

The fact that AC Spark Plugs are regular equipment in 60 leading American cars marks them at once as the standard—the ones recognized, tested, best of their kind—assuring maximum performance at minimum expense for the motor on which they are used.

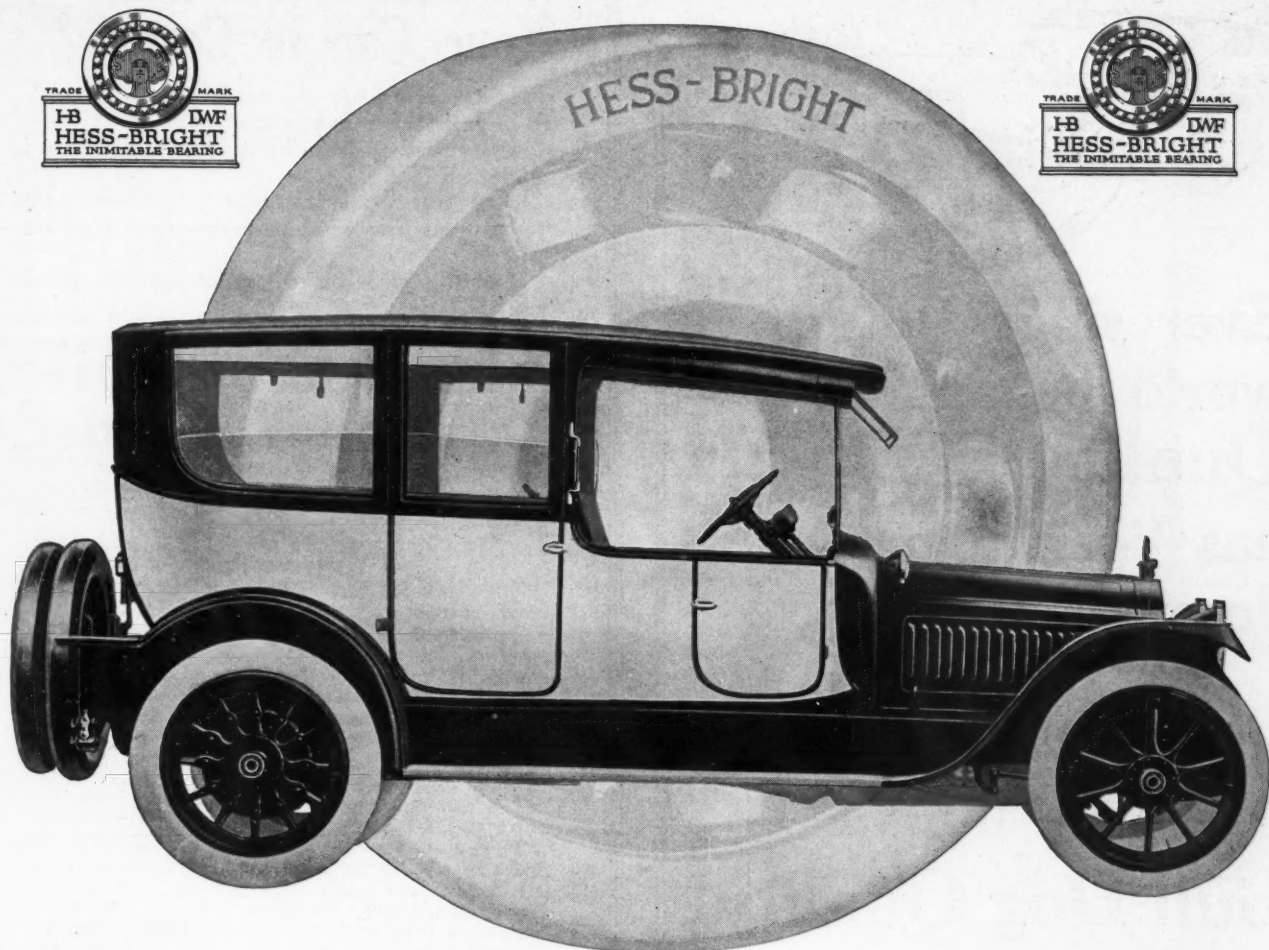
60

Builders of Automobiles virtually stake their prestige upon the absolute dependability of performance of AC Plugs.

Paterson	Glide	Case Tractors	G. M. C.	Knox	Monroe	Singer
Moon	Lexington-	Chase Truck	Gramm	Lambert	Pilot	Stephens
McFarlan	Howard	Daniels	Trucks	Maxwell	Sayers-	United Truck
Westcott	Austin	Empire	Jeffery	McLaughlin	Scovill	Wilcox Trux
Enger	Brockway	Federal	Kissel Kar	(Canada)	Crane-	Palmer-Moore
	Truck			Mercer	Simplex	

We also make a special spark plug for Ford, Overland and Studebaker cars that insures the highest efficiency for these motors. You cannot make any mistake by choosing the standard plug of America—used and overwhelmingly endorsed by these leading manufacturers. There's a difference—it will be appreciated by car owners.

CHAMPION IGNITION COMPANY
Flint, Michigan



HESS-BRIGHT BALL BEARINGS

are a quality product exclusively—the first cost is high.

It is but natural, then, that the manufacturers of one of America's finest automobiles, who insist upon the best, should prefer to use them.

THE HESS-BRIGHT MANUFACTURING CO.
PHILADELPHIA, PA.

HESS-BRIGHT'S CONRAD PATENTS ARE THOROUGHLY ADJUDICATED



Ever since the
world began
Quality
has been a pre-
dominating feature

It is perhaps for this
reason that

Bull Dog Quality

in Rubberized Mohairs
and Serges is so sat-
isfactory to both the
manufacturer and
the man that uses
the car.

*"A Quality you want at
the price you want to pay"*

SEND FOR SAMPLES AND PRICE LIST

L. J. MUTTY CO.

Boston, Mass.

Do You Know What Your Car Is Costing?

Is it costing too much?
Is your tire mileage too low?
Do you wonder why so much gasoline is
necessary?
Are your repair bills high?
Do you know what your gross cost per
mile is?
Do you wish to run your car as you do
your business?

The Automobile Expense Record

Solves All These Problems
Quickly and Accurately

To Stop a Leak—First Find the Leak

The Auto Expense Record might rightfully be considered an Efficiency Engineer, for, with the co-operation of the motorist it classifies every item of expense—records the miles traveled—shows the mileage yielded by each gallon of fuel and oil and by each tire. It provides a ready means for determining whether gasoline is giving the proper mileage—whether tires are wearing abnormally, and finally gives several pages of cost cutting recipes, any one of which should repay one hundred fold the cost of this little book and the time spent in keeping it.

The unnecessary expense and waste in the maintenance of the average car as computed by automobile engineers is appalling, and yet how few systematically endeavor to locate the waste-fulness of their own machine and eliminate it.

You know that carbonized cylinders will gradually increase your gasoline consumption, but how are you to know that your gasoline mileage is diminishing unless you carefully record it. Do you know when you last used a decarbonizer? You frankly admit that your car may be ruined in a ten mile ride because of lack of lubrication, but how do you keep track of your lubricant? When did you last screw down your grease cups? When did you load up your transmission and differential with lubricant? Time flies, the memory is treacherous—It may seem to you that it was done a week ago when in reality it was a month or more. The Auto Expense Record provides pages on which these things may be carefully recorded, that no lapse of memory may ruin your car or decrease its power to serve you well and inexpensively.

If it is necessary to make a claim of short mileage on a guaranteed tire, the record in your expense book may be needed to substantiate your claim. There are one hundred first-class reasons for keeping a record of your trips, your expenses and your cost per mile for gasoline, oil, tires, etc., and the above facts are only a few of those which might be given. It is reasonable to say that no book ever published has the power to do so much for the motorist as this little record which can be kept with a minimum of labor.

With one copy you can record your expense for three years.

THIS BIG PRACTICAL BOOK is the simplest yet most comprehensive record ever prepared. It is ruled in columns, covering every conceivable point the motorist wants to know.

Size 8x10½ inches. Handsomely bound in Silk Cloth, stamped in Gold.

Price \$1.50 Per Copy

MOTOR AGE MALLERS BUILDING **Chicago, Illinois**



"Whatever ar'ye doin', Pat, sticking that dollar bill doon that crack?"

"Why, I dropt a dime, an' I'm making it worth me while to pull up the plank."

Buying another tire of the same make to save the allowance due on an undelivered guarantee is a very similar performance.

Kelly-Springfield Automobile Tires - Hand Made

OUR tires are guaranteed for 5,000, 6,000 and 7,500 miles. They needn't be, for it doesn't do you any particular good. Save in the rarest instances, it brings you nothing. Cases when Kelly-Springfield tires fail to yield their guaranteed mileage are nearly as scarce as hen's teeth.

But the buying public expects a guarantee when it buys a tire, and we're willing to concede that to its prejudices.

Normally, Kelly-Springfield tires yield 8,000 to 10,000 miles—often 12,000 or more. Why shouldn't we be willing to guarantee 5,000 miles or more, if it makes anyone any happier?

If there were any doubt of them yielding 5,000 miles, we would only guarantee them for 4,000 miles, or even less. We are not selling guarantees; we are selling tire service. We don't want bickering over guarantees; we want satisfied customers only.

Once you buy a Kelly-Springfield tire, you keep right on using them. You forget about mileage, guarantees, or anything else but service.

That's why we are embarrassed by orders we cannot supply; why our users are willing to order their tires before they actually need them.

We don't like to be in that position, and disappoint loyal customers, but you can't increase the production of hand-made tires overnight.

We never have made machine-made tires. We have always built in mileage by hand. Of course, the tires cost more, but the service justifies the cost.

Few users get a chance to try Kelly-Springfield tires until they have tried other tires, for we cannot afford to meet price competition to equip cars at the factory, unless the car manufacturer can afford to pay our price.

If you want to know about the service they give, ask any Kelly-Springfield user, but don't expect to get Kelly-Springfield tires without ordering them in advance—unless you're born lucky.

Kelly-Springfield Tire Co.

Factories in Akron and Wooster, Ohio

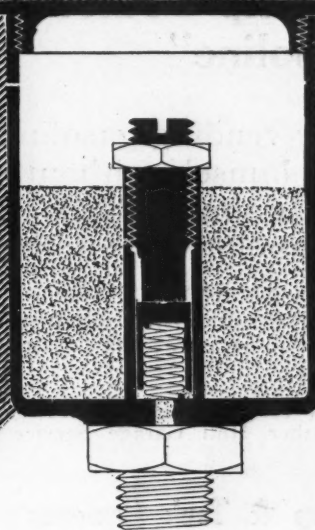
Executive Offices:

Broadway and 57th St., New York

Send 10 cents for the new game,
"Going to Market"



The Auto Graphite Lubricator



Scored Cylinders

It is not necessary to have your cylinders rebored. The scored and scratched places can be filled in with graphite and the metal built up so that the surface is restored to its original condition of smoothness.

You Save From \$25 to \$50

In addition to the cost of reboring your cylinders, you have to buy oversize piston rings and have them fitted. It all costs from \$25 to \$50 and your car is tied up for several days.

USE MOTOR GRAPHITE

It not only fills in the scored places but improves all the friction surfaces and makes your motor run smoother. It improves the compression, increases the power and saves both fuel and oil.

Graphite is successfully applied with our automatic lubricator. It pays for itself in a short time. You cannot make a better investment than to put one on your car.

Write us about lubricating YOUR motor with pure flake graphite.

We want a live representative in every city and town. Our proposition is a winner. Write us today.

The Graphite Lubricator Co.

326 DIAMOND ST.
PITTSBURGH, PA.



Start This to Work for You Day and Night

"The Help Yourself Way to Gasoline"

The new vending gasoline pump which enables the autoist to serve himself without disturbing you from your work or sleep. He simply drops required coin into slot and gets the proper amount of gasoline to the very ounce.

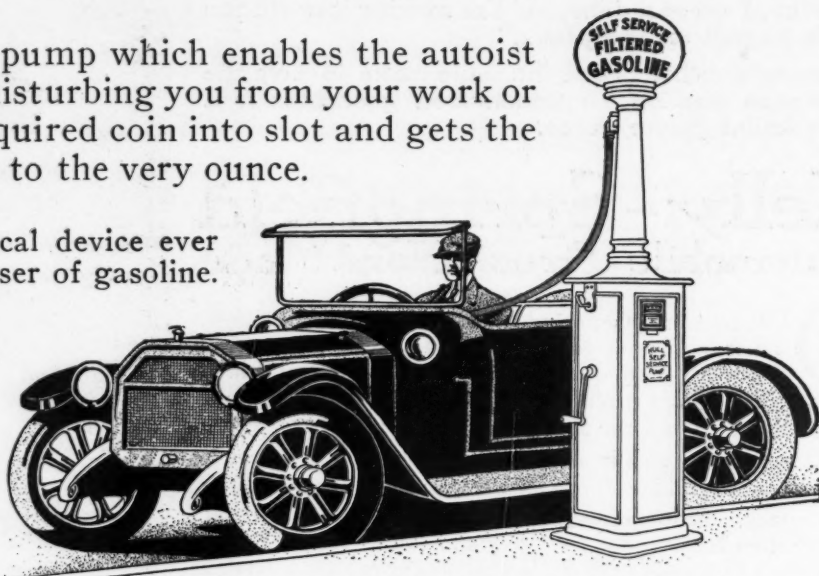
Most convenient and economical device ever invented for the handler and user of gasoline.

Write today for particulars regarding this, and other Hull Garage Service devices.

Hull Pump & Tank Company
Incorporated

Box 2401 Owensboro, Ky.

Salesmen Wanted Everywhere



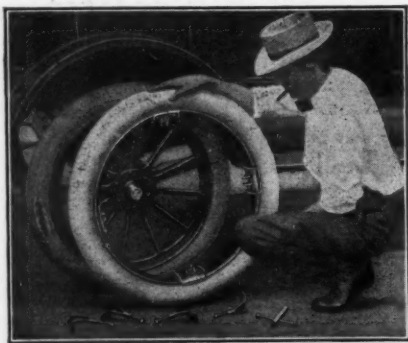
TWIN-RIM

PATENTED FEB., 1916

A Demountable
Rim for

Ford Cars

AND ALL OTHER 30"x3½" OR 30"x3" CLINCHER



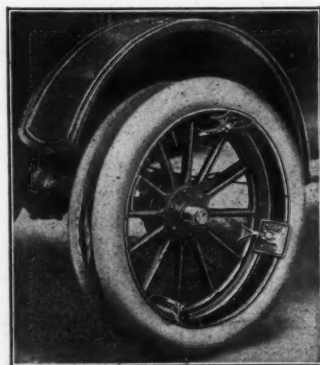
METHOD OF MOUNTING

You Don't Have to Remove Damaged Tires

It is strong and durable; looks well on your car. Fits either front or rear wheels. An absolute necessity for Doctors, Salesmen, Tourists, Taxicabs and Deliveries.

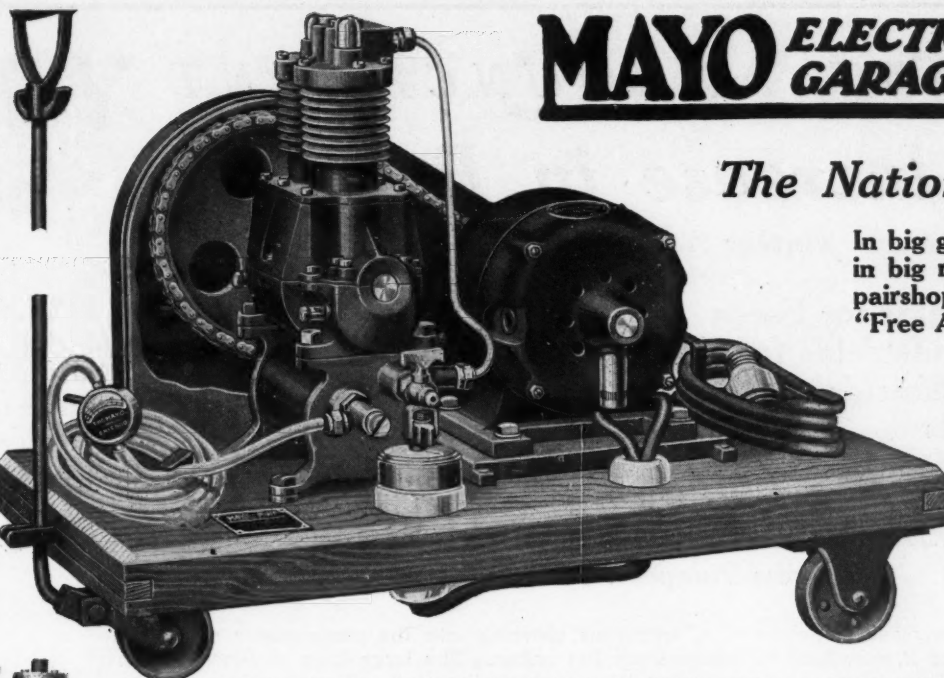
TWIN-RIM \$5.00
SPECIAL TIRE HOLDER FOR \$2.00

From your dealer or we will ship direct. Use for Thirty Days. If not satisfactory we will gladly refund your money.



MOUNTED READY TO RUN

TWIN-RIM CO., INC., 103 Massachusetts Avenue, Boston, Mass.

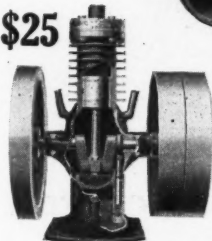


MAYO ELECTRIC GARAGE PUMP

The National Standard

In big garage and little garage, in big repairshop and little repairshop, you will find MAYO "Free Air" equipment dispensing satisfaction to customers who patronize only the garage or repair shop offering the up-to-date service.

\$25



Mayo Air Compressor

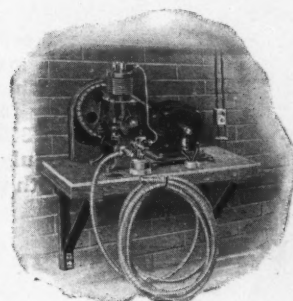
The garageman who knows most about the requirements of electric garage pumps invariably chooses a MAYO against the field. Due to material, construction and an international reputation of years' standing for all that is best in design and structure, MAYO "Free Air" garage equipment has become recognized as the standard of the motor car trade.

The MAYO Electric Garage Pump—either portable or wall type—at \$60 is the most popular electric garage pump on the market. It bears the MAYO Guarantee, and is sold on 30 days' trial.

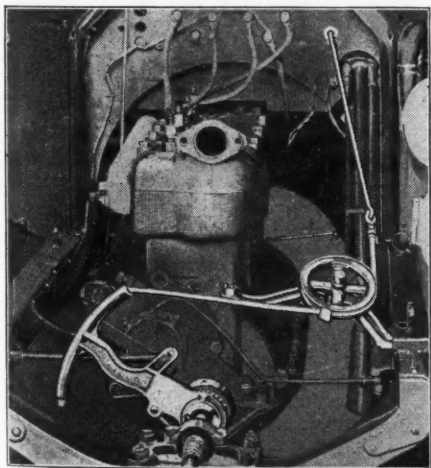
This pump is exceedingly economical of current. In ordering state current and voltage used. Send for free folder.

MAYO Air Compressor at \$25 is especially made for tire filling purposes, meeting with wonderful demand. It delivers pure, clean air only to the storage tank. Pressure 200 lbs. guaranteed. Send for full particulars.

MAYO MANUFACTURING CO., 55 E. 18th St., Chicago



Wall Equipment



Brinnon Starter Installed on Ford Cars

Strength—Simplicity—Durability Make

The Brinnon Starter

The Best on the Market for Fords

The foremost qualities of your Ford car are the keynotes of BRINNON Starter construction. To load the motor of your Ford down with additional connections, unreliable valves, or a maze of wires, is to undo the greatest good of Ford construction—and to pay a high price for undoing it.

The BRINNON Starter costs only \$10, and it is—

Absolutely Guaranteed

not only to be free from faulty material and workmanship, but to turn the motor past one firing point on every pull. The BRINNON Starter does not displace the crank. It just makes its presence unnecessary. So far as we are able to tell—and we check the performances of every BRINNON as closely

Price

\$10

Complete With Foot Primer

as possible—no BRINNON owner has ever been obliged to crank his car after installing a BRINNON Starter. Operates from the driver's seat. Eliminates danger from backfire. Cannot get out of order. Easily and quickly installed. Write for free illustrated literature and details.

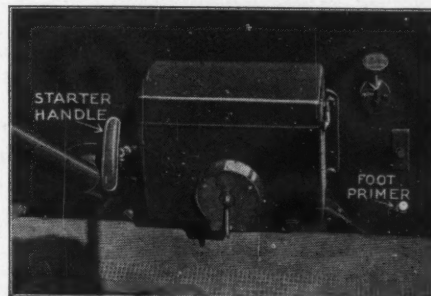
Special Dealers' Proposition. Write or Wire.

THE PETERS SALES COMPANY 75 S. GIFT ST. COLUMBUS, O.

THE PETERS SALES CO., 75 S. Gift St., Columbus, O.

Gentlemen: Enclosed find \$10.00 for which kindly forward one Brinnon Starter, special primer and all attachments, backed by your thirty day money back guarantee.

Name
Address
City



Brinnon Starting Lever and Foot Control on the Dash

When Writing to Advertisers, Please Mention Motor Age

IMPORTANT ANNOUNCEMENT

Increase in Prices

Further Advance July 15, 1916



	Present List	New List	
Universal Windshields for Fords	\$10.00	\$13.00	10% off
Conover Cowl Windshields for Fords	15.00	17.50	until
Commercial Cowl Shields	20.00	25.00	July 15.
Filler Board Shields	10.00	13.00	After that
Tire Savers (Set Four)	3.50	4.00	date full
			list.

Prices on SafTsteer, Front Radius Rod Brace, Rear Axle Brace and Air Press Pump for Fords not increased

The sharp increase in prices of all materials entering into the manufacture of windshields makes it necessary to increase our list prices. The large item of Plate Glass, of which we use only the best quality, is very high in price and very scarce. This country is now supplying the world with glass. Prices for materials have advanced 100 to 300%. We shall maintain our high standard of materials and workmanship. Until July 15th we will allow a discount of 10% on the above list prices, and after July 15th prices will be full list.

Page Woven Wire Fence Company Accessory Division **Adrian, Michigan**
DEALERS AND JOBBERS, WRITE FOR DISCOUNTS

You Can Reduce the Cost of Your Gasoline by Saving It with The Weldex Underground Tank and Pump

Cut out all the waste from your system of storing and using gasoline in your private garage, and reduce your fuel bills by getting mileage out of every pint.

Don't carry gasoline around in open sprinkling cans or pails, to evaporate while you let it stand, before filtering it into the tank of your car. Don't throw away the little that's left over after the tank is filled. And don't let it drip away to uselessness through a tap that does not cut the flow off short.

WELDEX Underground Tank and Pump system eliminates every vestige of waste, and is the—

Most Efficient Safety Device for Your Private Garage

Underground tank fills from outside the garage. Pump brings gasoline to your car in the garage in just the quantity you need. Returns all excess to the tank. None evaporates in hose or tube. Prevents chance of explosion or fire. Reduces fire insurance premiums.

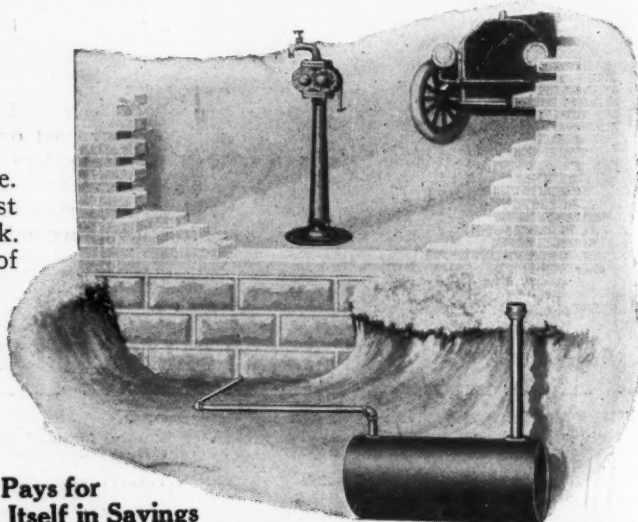
Write for prices and free literature describing WELDEX Gasoline Systems

WELDEX MFG. CO.

Cor. 12th and N. E. St.

Richmond, Ind.

**Pays for
Itself in Savings**



When Writing to Advertisers, Please Mention Motor Age



CONTROL!

The success of the Pitcher depends upon Control of the ball.

The comfort of the Motorist depends upon control of the REBOUND of the springs.

GABRIEL SNUBBERS

Make Your Car Ride Easier and Last Longer

Leading automobile engineers all recognize the need of Gabriel Snubbers.

Used on every type of spring and on cars of every price and class.

\$15, \$20 and \$25 per set of four; half that per pair.

Gabriel Mfg. Co., 1415 E. 40th St., Cleveland, O.



SEND FOR YOUR COPY

HERE is a story of real motor-car success—told in the best way—the right way, in fact—by the satisfied and enthusiastic owners of the car behind the book that is described and illustrated here.

The pages of this book bring to you a wonderful story of wonderful motor-car achievement. Achievement, first, in superior construction and design, and then in real, economical service—the kind that is the greatest of all tests of manufacturing efficiency.

Let the Satisfied Owner Tell You

The Story of this Astonishing Light Car Success—WOODS MODEL 5

We do not make a single positive statement throughout the whole of this story. We make no claims, advance no arguments, do not ask you to take our word for anything. Our only request is that you just let the authors of this book tell you their story. They'll do it in simple, non-technical language that all can understand. And they won't try to tell you what you should do after you read what they say.

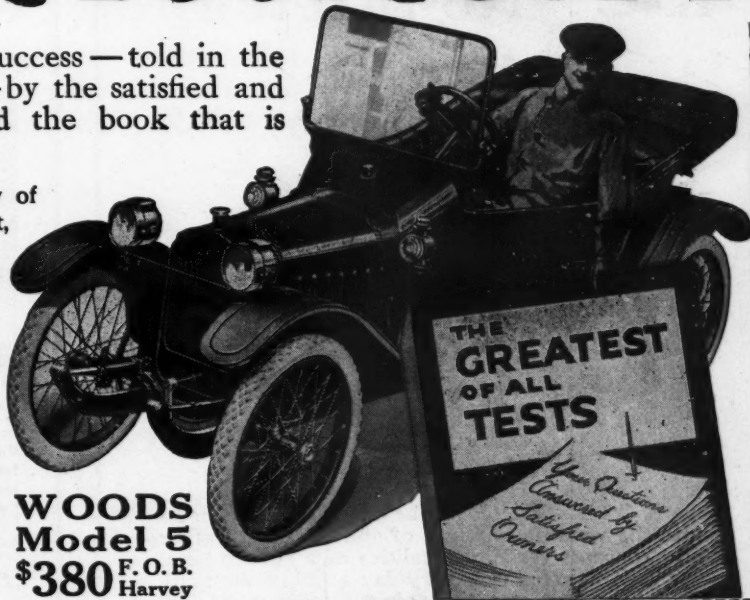
They'll just tell you what they've done with this wonderful car. Theirs will be a story of fact—actual road experience. A sane, sound and convincing narrative. So

SEND FOR "THE GREATEST OF ALL TESTS"

Then read it when it comes. Let the men who first actually made and then wrote the records set down in this great book show you just how the triple combination of *real Up-Keep Economy, Lightness-in-Weight and Low Price* work together in making this great car satisfy their first, last and every demand for allround, all-the-time efficiency and service.

No charge for it. Just send your name and address. Use the coupon and your copy of this book will come to you by return mail. For prompt attention address Desk 1

WOODS MOBILETTE COMPANY, 1509 Michigan Blvd., Chicago, Ill.



WOODS Model 5
\$380 F.O.B. Harvey

Woods Mobilette Company
Desk 1 1509 Michigan Boulevard
Chicago, Illinois

Please send me (free of charge at once) a copy "The Greatest of All Tests."

Name

City

Street.....State

The New 1917 Model Imperial Any-Angle Wrench

One wrench for every purpose, the wrench of a thousand uses. It does the work of an entire kit of wrenches. It reaches nuts in the most inaccessible places. By simply pressing the button, handle can be adjusted to any angle. Release the button, handle is rigidly locked. It is 9" long, takes any nut up to and including 1 1/8". For utility and labor-saving value, this wrench has no comparison. It is made of the finest material and absolutely guaranteed. Send us a \$1.00 bill, and we will mail you one postpaid. If not as represented and absolutely and everlastingly satisfactory, we will return your money.

Dealers Write for our special guarantee sales plan on this, the biggest seller in the wrench line.

Imperial Tool Company
Dept. B2 Bloomington, Ill.



MOTOR TOURISTS!

LOOK AT THIS — IT'S A WONDER
The Enterprise Tent-Cot

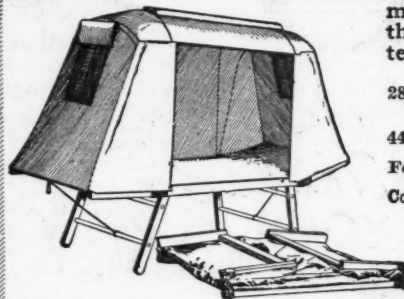
Carry your own Hotel. Always ready. No bother or expense.

Three Tent-cots strapped to the side of an auto. Always ready.



There is nothing to equal the Enterprise Tent-Cot for that "rough and ready" trip this summer. It is waterproof, light, airy and comfortable, and the most complete and convenient out-door bed you ever saw.

Automobile agents can make big money selling this cot. Write for terms.



Sizes
28 in. wide, 78 in. long
Weight, 29 lbs.
—OR—
44 in. wide, 78 in. long
Weight, 44 lbs.
Folded, 28x36x4 in., or 44x36x4 in.
Colors — Tan or Olive Green
Write for catalog
ENTERPRISE BED CO.
HAMMOND, INDIANA

K-C "No-Stretch"

1000 Mile
Blowout Boot



ONE LAYER CHROME LEATHER
TWO LAYERS TIRE FABRIC

Two Boots in One

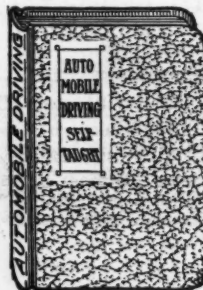
The K-C "No-Stretch" is the only Boot that combines the wearing strength of steel studded leather and the water resisting qualities of a rubber boot. It is built to stand the every-day grind of the road. No matter how wet the going, it cannot stretch, because steel studded chrome leather tread is vulcanized and riveted to a heavy carcass of rubberized tire fabric, thus giving, in addition to the hardest possible tread, absolute protection against the effects of water.

The General Tire & Rubber Co.
Akron, Ohio

Automobile Driving Self-Taught

By THOMAS H. RUSSELL, M. E., LL.B. Author of "Ignition, Timing and Valve Setting," "Automobile Motors and Mechanism," "Motor Boats: Construction and Operation."

An exhaustive treatise on the Management, Care and Operation of Motor Cars. Pocket size, 230 pages, liberally illustrated, handsomely bound in black seal flexible leather, round corners, red edges.



CONTENTS

Automobile Driving—General Instructions—Starting the engine—Advancing the spark—How to change speeds—Use of the Clutch—The Control levers—Principle of gear changing—The engine as a factor—Use of brakes—Causes of irregular firing—To avoid sideslip—The tire bill—Gear missing in speed changes—Engine thumping—Driving on the brake—How to get the best work out of a motor—Skidding or side-slip.

Self-tuition in driving Continued—The initial trip—Charging tanks—Starting the engine—Manipulating the control—Correct mixture—Changing gear—On the top speed—Withdrawing the clutch—Coasting slopes—Picking up the Drive—Driving on the reverse—Entering and leaving the garage—After the drive—Road risks.

Another lesson in driving—Learning the steering and Control—Preliminary attention to car—Start—

ing—Changing speed—Coasting, braking and reversing—Sources of side-slip—To avoid skidding—Non-slip devices—Choice of Track—Speed limits—Conduct in emergencies—Driving through city traffic—Meeting horses, cattle and cyclists.

Difficulty in starting—Symptoms, causes and remedies.

Involuntary stops—Causes and remedies.

Loss of power—Causes and remedies.

Care and maintenance of motor cars—Private housing—The garage—Cleaning—Lubricating—Care of tires.

Care of a car on a tour—Engine treatment—Overhauling the ignition apparatus—Accessories and tools for the tour—stabling the car.

Laying up a car—Cleaning the engine—The transmission gear—Connections and chains—The lubricators—Tire treatment—Laying up for the winter.

Gasoline—Its properties and Economical Use—Production of Gasoline—Its distillation—Specific gravity—Vaporization experiments—Proper design and function of the carburetor—The ton mileage method of arriving at economy—Quality of the fuel.

Gasoline hints and tips.

Operating mechanism of a modern car.

Choice of a car, Etc.—Considerations of price and cost of maintenance—Small and large cars—New and tried types—Second hand cars.

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Don'ts for motor car drivers and tire owners.

PRICE, Flexible Leather, \$1.50. Cloth Binding, \$1.00

MOTOR AGE

Mallors Bldg., CHICAGO

As Handy As Your Electric Starter

and a lot more necessary.

Slip an All-Over under your seat, and the dirty jobs around your car, in the garage or on the road, won't worry you.

Light in weight, dustproof, and they slip over your clothes in a jiffy. Can be washed.

ALL-OVER

Just the thing for those who drive their own cars and make their own minor repairs, and for mechanics in garage or factory.

**\$3.00 AT YOUR SUPPLY
DEALER'S
OR WRITE TO US**

Dealers Wanted—Thousands Sold.
An All-Year Profit Maker to
Those Who Handle It.

Points of Superiority

- 1 Military Collar
- 2 Watch and Pencil Pocket
- 3 Safety Flap Pocket
- 4 Side Pockets with
& Openings into Trouser Pockets
- 5 No Loose Belt to Catch in Machinery
- 6
- 7 Adjustable Sleeves
- 8 Rule Pocket
- 9 Adjustable Legs

Opens Down Front
Easily Laundered
Fast Color Khaki Material
Made in all sizes
Guaranteed

Ohio Overall Co.
WOOSTER OHIO

—for the price of 12 gallons of gasoline

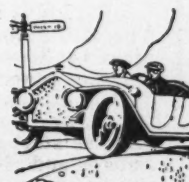
The cost of an Ingersoll Reliance Watch is about the same as the cost of twelve gallons of gasoline. The one will provide you with power for some 200 miles of travel; the other means accurate dependable time for many, many years.

The Ingersoll Reliance is the first flat, accurate *jeweled* watch to sell for anywhere near *three dollars*.

*The Man Behind
the Counter*



Ingersoll
RELIANCE \$3



The Reliance is one of several Ingersoll models for motorists. There is also the jeweled Waterbury, a little smaller, \$3.00; the "Handiwatch," an Ingersoll in a steel holder that fastens to dash or steering wheel, \$1.25. Send for interesting catalog. Robt. H. Ingersoll & Bro., 315 Fourth Ave., New York.



Grips rounded nuts
Reaches inaccessible places

One
**Marvel
Adjustable
Socket
Wrench**

Does the Work of an Entire Set of Sockets

Grips any nut—mutilated, rounded or odd-sized—like a vise. Gets into places inaccessible to the ordinary socket wrench without stopping to change the socket.

MARVEL Adjustable Socket Wrench is drop forged steel. Ten times stronger than cast iron or stamped wrench. As efficient as a monkey wrench, and easier to handle. Takes the place of a \$10 socket wrench—for only \$4.

From your dealer, or write us
direct, for free literature and details

Special Dealers' Proposition. Write

Send for Complete Catalog
of MARVEL Accessories

The Marvel Accessories Mfg. Company
1218 W. 6th Street Cleveland, Ohio

DIXIE 20TH CENTURY MAGNETO

No electrical lag—no coaxing and juggling with the spark lever—extra speed and added power instantly at command and not at the dictates of the engine—are three important advantages that magneto ignition has over any form of battery ignition, automatic or otherwise.



**SPLITDORF
Electrical Co.**
NEWARK, N. J.

(All SPLITDORF features
are fully covered by patent
or patents pending)

Pittsfield "Micatite" Spark Plug



wears the *Blue Ribbon* in the Combination Plug class. It does not leak compression. Electrodes practically carbon proof. Composition top heat-proof, cold-proof, water-proof, gas-tight, difficult to break and never works loose. *Meteor Sparking Wires*. Easily cleaned by removal of check nut.



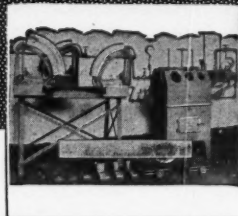
Here is the BERKSHIRE 96b for Fords

It has an *extra long shell*, and the *specially imported Kaolin Porcelain* used in this plug was fired at extreme heat to insure *extraordinary durability*. Same *self-cleaning* design as standard plugs. Meteor wire, the highest grade alloy known for this duty, is used for sparking points.



PITTSFIELD SPARK COIL CO.
PITTSFIELD MASS., U. S. A.

This Is The TIRE REPAIR MANS HARVEST TIME



Start a Tire Repair Business Now

This is the time of year when tire repair men are making young fortunes. You can start now and get the cream of this year's business—IF YOU ACT QUICK.

TIP-TOP OF AKRON TI-RE-PAIR OUTFIT

We have the "TIP-TOP" in stock ready for immediate shipment. Send in your order now, and get into this wonder business. **START RIGHT.** Get a TIP-TOP TI-RE-PAIR outfit. It is in a class by itself!—does better and quicker work.

Write today for complete information.

Send for our Free Booklet, "How I Would Conduct a Tire Repair Business." Don't start in the Tire Repair Business without reading this booklet.

The Akron Rubber Mold & Machine Co.
Builders of Tire Manufacturing and
Repairing Equipment

919 SWEITZER AVENUE, AKRON, OHIO

Please send me copy of booklet "How I Would Conduct a Tire Repair Business." I would like to start a tire repair business. I am interested in the TIP-TOP outfit.
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Address
M. A.



Theft-Proof

In the United States about 3000 cars were stolen during 1915, because they were not equipped with

POWERSTEEL AUTOWLOCK

The Powersteel Autowlock consists of a four-foot waterproofed length of the famous Yellow Strand Wire Rope, two strongly spliced eyes and a non-pickable lock. Thieves won't steal your car or spare tires when "Autowlocked" and some insurance companies even go so far as to reduce their rates 10 per cent when it is used. Buy a Powersteel Autowlock from your dealer today; the price is but \$2.00.

BASLINE AUTOWLINE is another necessity. It assures a "tow home" and can be used in an emergency as a substitute for tire chains or for pulling your car out of ruts on its own power. It's about 25 feet of Yellow Strand Wire Rope, coils up flat under a cushion and weighs but 4½ lbs. Price, east of Rockies, \$3.95.

POWERSTEEL TRUCKLINE is for heavy towing, the "big brother" of Basline Autowline. Price, east of Rockies, \$6.50.

Write for FREE literature

Remember, too, that there's a B. & B. Wire Rope for every purpose—the best wire rope. As evidence, B. & B. wire ropes have been identified with practically every big engineering project during the past 40 years.

BRODERICK & BASCOM ROPE CO.

813 N. 2nd St., St. Louis, Mo.
NEW YORK OFFICE 76 E. WARREN STREET



A Safe, Certain, Bright Light at Slow Speeds for FORDS

The VAN SICKLEN Concentrator assures such a light at slowest engine speed, when you need it most.

At 5 m. p. h., 10 m. p. h. or 15 m. p. h. with a VAN SICKLEN Concentrator you always have sufficient light for every driving purpose. \$2.00—the price of the Concentrator—is a very small price to pay for so necessary a convenience.

\$2



VAN SICKLEN AUTOMATIC HEAD LIGHT CONCENTRATOR FOR FORD CARS

The VAN SICKLEN Concentrator at all speeds below 15 m.p.h. automatically disconnects the right headlight, shunting double current into the left headlight. At 10 m.p.h., for instance, the left headlight burns as brightly as it ordinarily would at 20 m.p.h. Above 15 m.p.h. the regular Ford 2-lamp system automatically re-asserts itself.

Price, \$2.00 complete, ready to put right on. Easily installed. Full instructions with each order. Installed under hood on dash. Guaranteed not to injure magneto, or bulb. Neat, compact, handsome.

Obtainable from most good dealers or sent prepaid direct upon receipt of price.

Dealers: Some desirable territory still open. Over 600,000 prospects. 40,000 sold in last two months. Wire or write.

The Van Sicklen Company

14 Chicago Street, Elgin, Illinois Note simple installation



In Every Instance

where Eclipse Piston Rings were installed in automobile engines the owners have attested that there was a tremendous increase in power.



This is Proof; the Reasons are in the Ring.

Send for Catalog and Price List.

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Manufactured by
HOPE MACHINE CO., Philadelphia, Pa.

THE EDWIN T. CRAVEN CO.

Sole Distributors

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This Trade Mark Guarantees EVERLOC

The Patch That Won't Come Off

Time has tested the holding power of EVERLOC Patch. The hardest kind of service on pleasure and commercial cars has proved its tenacity. There are—

Nearly 300,000 Actually in Service

—some of them on the same tube for two seasons—and one has never melted or worn off. For repairing small punctures and big blowouts. Cut it from the sheet, to fit your needs. No waste. A cold cementless patch.

For the best results when you buy a patch say "EVERLOC."

Send coupon and 10c for sample patch, sufficient for several repairs

DEALERS, WRITE FOR LIBERAL PROPOSITION

3 Sizes, 50c

\$1

\$1.50



W. C. WOOD CO.

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W. C. WOOD COMPANY

40 N. 10th St., Minneapolis, Minn.

Enclosed find 10c, for which send me sample EVERLOC Patch, sufficient for several repairs.

Name

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Protect Your Car from Theft



K-W Autolock Switch
For Fords

\$3.50 Complete

It takes the place of the ordinary switch, and can be attached to any make coil in five minutes. Its operation is as simple as locking a door. Your key in your pocket is your assurance that you will find your car locked, right where you left it.

Without the key it is impossible to operate the switch. Removing the screws will not remove the lock, unless YOUR key is inserted. The K-W Autolock Switch is sold by reliable dealers everywhere at \$3.50. If yours is out, sent prepaid on receipt of price.



with a



AUTOLOCK SWITCH



For
All Ford Cars

\$16 Is Enough to Pay for Streamline Equipment for Your Ford Car

There's nothing wrong with the body that comes on your Ford car. No need to throw it away and buy a new one, at half the price of the entire car.

\$16 is a moderate investment you can afford to make for the—

Detroit Streamline Hood and Scroll Type Radiator Shell

—that brings your car up to date in appearance. To spend more is unnecessary, and out of proportion to the value of your car.

DETROIT Equipment is for all Ford cars—not just cowl dash models. Built of substantial sheet steel, with concealed, water-proof hinges. Finished in black enamel that lasts. Ask your dealer, or write us for free illustrated literature telling how to keep your Ford car in style, with DETROIT Streamline Equipment.

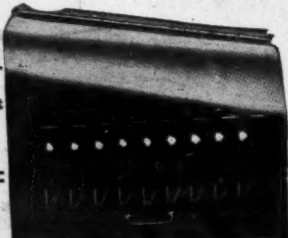
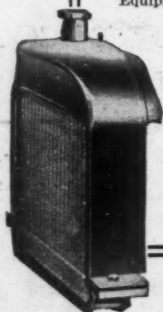
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The new Schrader Quick Acting Dust Cap will facilitate the work of testing the air pressure in your tires, and at the same time add materially to the appearance of your car.

The new Schrader Quick Acting Dust Cap can be removed from the tire valve stem without effort and with the loss of about one second. It eliminates the labor of screwing the cap down the entire length of the valve stem to the fellow of the wheel.

All that is necessary is to slip the cap over the valve, and give it a slight turn until tight (usually less than a complete turn). This locks it securely to the valve stem. To unlock, simply give it a slight turn in the opposite direction.

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Two dollars for set of five

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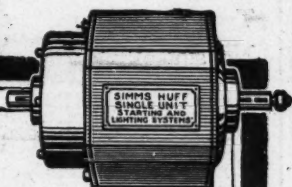
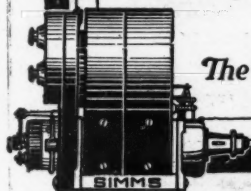
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"I would say that for your Simms Magneto, we have the highest regards, as they have never given us the least particle of trouble."

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Quality Reliability
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The SIMMS MAGNETO CO.
East Orange, N.J.



OSPECO Streamline Hood and Radiator Mask or Shell FOR FORDS

Typifies the prevailing style in motor car designs, accepted by the highest priced cars. A dignified equipment with rich, sweeping lines. No blundering defects mar the patrician atmosphere of your Ford, dressed in the season's best—not its gaudiest.

OspecO Equipment will not be common. It is exclusively for the newest Fords.

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WARNING: The OspecO Streamline Hood and Radiator Shell is manufactured under United States Letters Patents No. 1156017, and U. S. Design Letters Patents No. 47162 and No. 47854. All infringements will be vigorously prosecuted.



The OspecO can be put on in 15 minutes. Made of 22 gauge steel as used in all standard cars, and brilliantly enameled.

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Complete
Nickel Finish
\$1.00 Extra

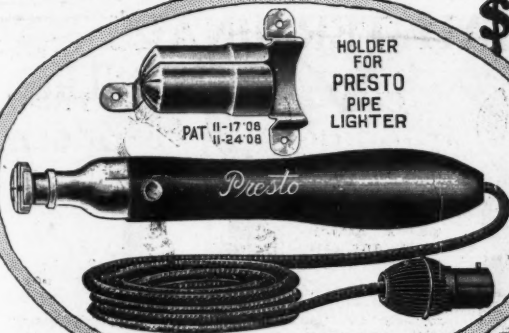
Dealers — The trade you want will pay for OspecO.—Write.

THE OSPECO
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574 Franklin St.
Detroit, Mich.



For All
1915-16
Cowl Dash
FORDS

\$1.50



The New

Presto Pipe and Cigar Lighter

The latest addition to a popular line. Combines two necessities in one—a pipe and cigar lighter in a self-contained unit. Will light equally well pipe, cigar or cigarette. Very popular—a sensational seller. Price, complete with "Tungstenite" Chromium nickel 6-volt lighter tip, full nickel-plated holder, 10 ft. of cord and Edi-Swan plug as illustrated, \$1.50. Unless otherwise specified, 6-volt outfit will be sent on order. 7 or 8-volt outfits supplied at no extra cost. For 10, 12 or 14-volt tip, add 25c.

DEALERS: Six of these pipe and cigar lighters are mounted on an attractive display card for counter use. Ask your jobber.

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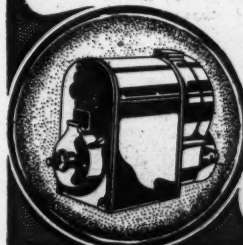
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The performance of any motor, however good, will be spoiled by undependable ignition. The manufacturers know this. They won't take chances. This is why Eisemann Magnetos have been adopted as standard equipment by 108 Manufacturers of Trucks, Tractors, Pleasure Cars, etc! Eisemann Ignition is powerful, dependable, a guarantee of a

SURE-FIRE SPARK

at low speed, at high speed, at any speed



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Winton Six cars can't be stolen successfully. The distinctly individual appearance of each Winton Six makes its identity and ownership sure at sight. Your friends know you are coming the instant they see your car. We give each buyer his choice of thousands of body and finishing combinations with the result that your Winton Six is always visibly your own personal property—a beautifully different creation.

Two sizes—33 at \$2485, and 48 at \$3500. Write today for catalog.

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424 Berea Road, Cleveland, Ohio, U. S. A.

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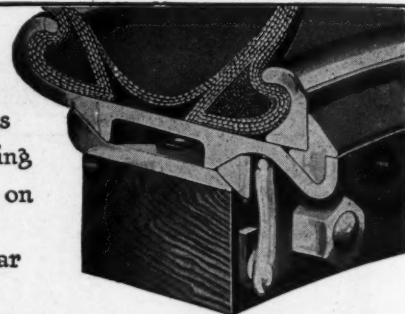


PRICE \$1.00 AT ALL DEALERS

Stone Insulator.
Absolutely gas-tight.
Has no equal for Speed and Power.
Sizes and threads for all motors.
New schedule of trade prices.

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True alignment
No squeaking
No complicated parts
No rusting or sticking
Continuous bearing on
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A rim for every car



Firestone Rims

Quick

Detachable

Demountable

Use Half the Fuel

**AUTOMATIC
CARBURETOR
REGULATOR**

A Super-heated steam device, not a recon-structed petcock.

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Every Motorist Needs a

Shanhouse MOTOR SUIT



A one-piece garment which slips on and covers your clothes completely. This garment is made especially to meet the urgent need of motorists.

Made of olive khaki—slips on in a minute, over all your clothes—off in a second. Big, roomy, comfortable, washable. Costs but \$2—the price of having two suits cleaned. You can't afford to be without one.

Don't change your clothes every time you change tires, or tinker with your machine. Have a Shanhouse Motor Suit always in your tool box.

If your dealer cannot supply you send \$2, giving chest measure and dealer's name. We will send you one direct, prepaid. Money back if not satisfied.

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For Ignition, Starting, Lighting Systems



Ferrule Clip
($\frac{1}{2}$ Actual Size)

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Ferrule Clip furnished to fit any wire up to $\frac{1}{2}$ " in diameter.

Wing Clip for quick attachment any size cable.

Collars supplied with Clip Terminals to use with any plug.



Style A
Loop No. 1
(Actual Size)



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(Actual Size)

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Style "A" made in 3 lengths from the bend of the Ferrule, $\frac{1}{4}$ ", $\frac{11}{16}$ " and $\frac{13}{16}$ ".

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Primary with ferrules same as Ferrule Clip.

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Why is that? Because Detroit Batteries are made in styles and sizes to fit every car and starter. Not a "make-fit" but built especially to suit. We can fill orders for any car in your territory. Just give us the name and model.

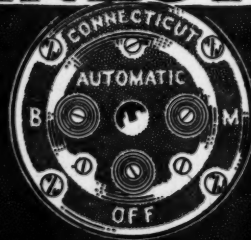
Write for our exceptional Dealers' Offer

Detroit Battery Co., Detroit, Mich.



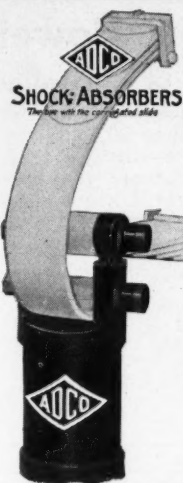
AUTOMATIC · IGNITION CONNECTICUT

Gives the most effective spark at every speed for four, six or eight cylinder motors.



Delivers hottest spark at low speeds and a better spark than the magnet at high speed.

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The only Shock Absorbers of the Spring Type to be recognized by the Car Makers.

Used As Standard Equipment on



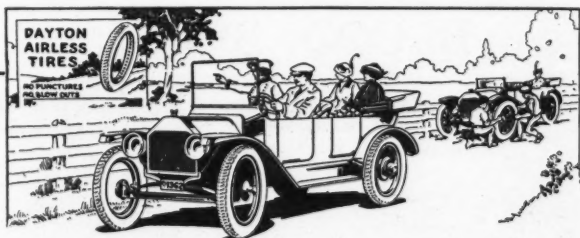
"ADCO Equipped"

\$20

The Set for Rear Springs

Auto Device Mfg. Company
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Insist on your new car being ADCO EQUIPPED. Be sure to have your present car ADCO EQUIPPED. "Comfort First"—100% ease in motoring—85% less spring breakage—35% greater tire mileage. DEALERS—Get in on the demand for ADCO. Write us for liberal dealers' discounts TODAY. Write for Bulletin No. 11 on ADCO Bumpers.



Takes Trouble Out of Tires

The car owner whose machine is equipped with Dayton Airless Tires never worries about punctures and blowouts. He spins along with the joyous knowledge that the pleasure trip cannot be spoiled by tire trouble. He knows that they are always ready to serve. They never have to be pumped up.

Eliminate your tire cares by using

DAYTON AIRLESS TIRES

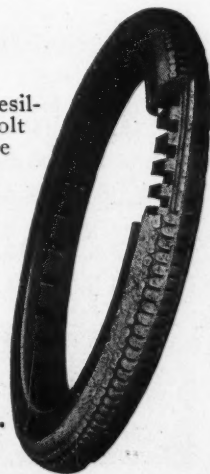
They are built with pieces of live, resilient rubber that absorb all jar and jolt and make riding comfortable. They are backed by seven years of service and tens of thousands of satisfied users.

8,000 Miles

guaranteed on Dayton Airless for Ford cars—5,000 miles for heavy cars. They cut the cost per mile as compared to other tires.

Write now for descriptive booklet and prices. Dealers! There's big money in Dayton Tire agencies. Write at once for our new dealer's offer. It's a winner.

The Dayton Rubber Mfg. Co.
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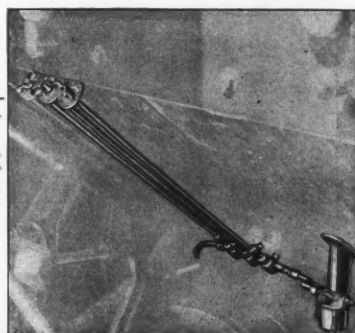
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**25% More Pay
One Week Vacation**

Fifty expert automobile mechanics wanted. Will pay 25% more than current wages and give one week vacation (at full pay, yearly). Only married men, at present employed and with at least 3 years' experience, considered

C.T. Silver Motor Co.
57th St. and Broadway New York

The Lock That Can't Be Picked



Price Complete \$5

Don't Wait Until the Car's Gone Before You Lock It Up

Don't be like the man who locked the doors after his horse was gone. Be prepared in advance to prevent thieves taking your car from the curb, disguising and repainting it, and making it impossible for you ever to identify it again.

**J-R-B Combination Lock
Makes Your Car Thief-Proof Always**

Cannot be unlocked by any trick of sound or touch, methods used in picking ordinary combination locks. Does not assemble a combination in the Knob. Operates on the gasoline line, under the floor. Works fast and easily if you know the combination. Withstands the best efforts of expert crooks who may try to tamper with it. If forced, temporarily blocks the gasoline line. Installed by any garage man in an hour. Outlasts your car. Guarantees its safety always.

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A Dealers' Proposition that Means Money on Easy Sales. Write.

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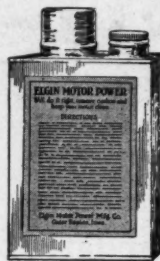
STANDARD for Chevrolet "Four-Ninety"



Built on the tried and true centrifugal system which does not alter. Hand steady as a rock at all speeds.
Handsome nickel flush mounting makes it an ornament to your car.
Guaranteed country-wide service assures your lasting satisfaction.

\$15 DEALERS write for proposition

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Elgin Motor Power Cuts the Cost of Gasoline

—by increasing the mileage you can expect per gallon from 10 to 20%.
Keeps the motor alive—always ready and able to do a little more than you call for. Eliminates carbon, keeps spark plugs clean, and increases the power wherever used.

Non-injurious when mixed with your gasoline.

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GOOD PROFITS ON BIG BUSINESS**

The Elgin Motor Power Mfg. Co.
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Your Life May Be the Forfeit

—if your foot slips at a crucial moment. One Dollar will prevent its slipping.

Rives Auto Pedal NEVERSLIP PADS

not only eliminate this danger, but keep your feet cool in summer (rubber is a non-conductor of heat), save your shoe soles, and put you in favor with the Insurance People, who have strongly endorsed Rives Never-slip Pads.

Take no chances. That dangerous moment may arrive tomorrow.

Order a set of Never-slips now!

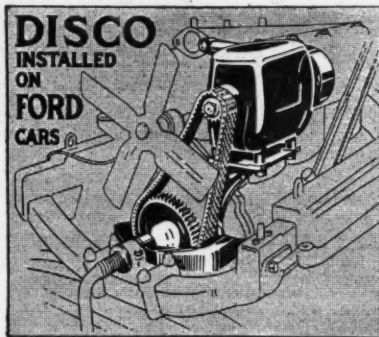
When ordering, state make, year and model of car.

Special Models
No. 1—For Ford, all models. No. 4—Maxwell, 1916.
No. 3—Overland. No. 5—Dodge Bros., all models.

PRICE \$1.00 PER SET Any Model

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ELECTRIC STARTING AND LIGHTING SYSTEM FOR FORD CARS

The Disco operates on a twelve-volt current and is absolutely the most powerful starter made for Ford cars. Single unit system, simple, light, reliable. Mounted on patent yoke bracket which maintains alignment and prevents chain troubles. The Disco SPINS the motor, insuring a start every time.

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\$75
Complete

Gould STORAGE BATTERY

*The Strong Right Arm of a
Starting-Lighting System*

GOULD STORAGE BATTERY CO.
General Offices, 30 E. 42nd St., New York

Write for our Agency Proposition

BLOOD BROS. Universal Joints



Each working bearing has its own positive supply of lubricant and is individually enclosed oil and dust tight.

The only high grade joint of the open type

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CORCORAN-VICTOR CO.
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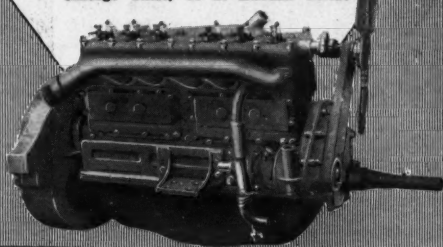
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PROPELLERS**

**Salisbury Wheel
& Mfg. Co.**
JAMESTOWN, N.Y.

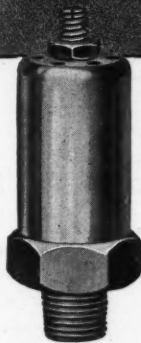
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Over 10,000 live dealers enjoy selling
RUTENBER-Equipped cars.

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Marion, Indiana
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Saves Gasoline Increases Power Gives Greater Speed



Ask your dealer to show you this new valve
that saves 15 to 35 per cent of your fuel bill
and gives your engine more power. It is
called the

BRUGAN **\$4**
Economy Valve

It automatically admits air to the intake manifold, thus
improving combustion, and making the engine more brisk
and sprightly. If your dealer can't sell you one, write for
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\$4-4

THE BRUGAN COMPANY, Bangor, Maine

DON'T PAY MORE Than Ironclad Prices



Take advantage of IRON-
CLAD quality and economy.
Best material and most care-
fully selected stock. Com-
bine all advantages of tires
you buy at twice the price.
Sell with longest written
guarantee. Write for com-
plete details, and prices on
all sizes.

A Chance to Save
Without Quality Skimping
Ask for prices on Special
Guaranteed Ironclad tubes.

Ironclad Tire Co.
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—even this old boy
is hitting on all cylinders

BUT—Has Wasting Fuel

Don't think because your engine is
hitting on all cylinders you're getting
maximum service!

Write us for astonishing carburetor
revelations—new facts you've probably
never heard of—learn how the New
Stromberg Carburetor will increase
the power, speed, acceleration and gas
economy of your car whether it is new
or old. Be sure to state name, model
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New STROMBERG Does it!
CARBURETOR

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The BLUE

RIBBON

for demonstrated superiority distinguishes every single part of the
LARRABEE-DEYO Truck

a combination of supreme quality, made up of parts selected from
the very pinnacle of manufacturing excellence.
Continental Motor, Model "C," three point suspension type, 4 1/2 bore x
5 1/4 stroke. Prevents torsional frame strains being taken through motor
body. Special drop forged connecting rods and crankshaft.



1 1/2 and 2 to 3 1/2
ton capacity.
Territory being
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Deliveries Now.

LARRABEE-DEYO
Motor Truck Co., Inc.
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\$740 PULLMAN \$990 MOTOR CARS

The new Coupe De Luxe with C-H Magnetic Gear Shift,
built and beautifully finished primarily for women, is a
splendid example of the products of the Pullman
factory. (\$990)

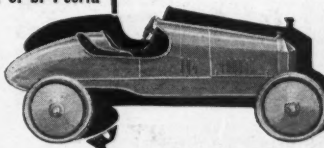
Pullman cars are attainable in a Five Passenger Touring
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chassis (114-inch w.b.) at \$740.

Good territory for this fast selling line is still open to live
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The Pullman Motor Car Co., York, Pa.
ESTABLISHED 1903

"FASCO" RACING BODIES

Models
H. \$115.00
L. \$85.00
f. o. b. Peoria



The "Fasco" Racing
Bodies are meeting with
universal approval. Built
to wear. Ride without
noise. Easily mounted.
Sold complete at reduced
prices. Agent wanted in
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Atwater Kent Ignition



For Your Car
Atwater Kent Mfg. Works
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PITTSBURGH SEARCHLIGHTS FOR ALL CARS

Have you a Searchlight to suit every customer? The Pittsburgh Line is complete, from the most powerful Searchlight made to the lightest and smallest. Large stock of Pittsburgh Dirigibles and other types ready to ship the day your order reaches us.

Pittsburgh Electric Specialties Co., Pittsburgh, Pa.

ILLINOIS Automatic Windshield Hinge Makes Windshield for Fords Clear-Vision and Ventilating



The only windshield hinge made of tempered steel, and guaranteed for the life of the car. Fits any 1915-1916 Ford with cowl dash. Special hinge for 1914 Ford. Easy to attach. Simple adjustment for perfect ventilation and rain vision. Richly finished in black enamel. Price, \$3 per pair.

If your dealer or jobber can't supply you, remit \$3 and we will send prepaid

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226-232 W. Ontario St. Chicago

A Life Saver in Hot Weather





Settle the
**MILEAGE
PROBLEM—**
Use

QUAKER
RUBBER

Miles Cheaper

Users Report
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8,000
10,000
12,000
15,000

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**Quaker City
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You don't just expect good service from **BRAENDER** TIRES & TUBES —you get it

Write for particulars about **BRAENDER Bull Dog Non-Skid—THE FASTEST, SAFEST, SMOOTHEST RIDING TIRE MADE.**

Braender Rubber & Tire Co.
Factory: Rutherford, N. J.
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BRAENDER 250 West 54th St., New York, N. Y.
Bull Dog 1327 Race St., Philadelphia, Pa.
Non-Skid 1350-54 So. Michigan Ave., Chicago, Ill. Trade-mark





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Electric Starting and Lighting Systems

**SINGLE UNIT and
TWO UNIT Equipments**

Booklet on Special Ford Equipment

DYNETO ELECTRIC CO., Syracuse, N. Y.

Add to Garage Profits by Oxy - Acetylene Welding

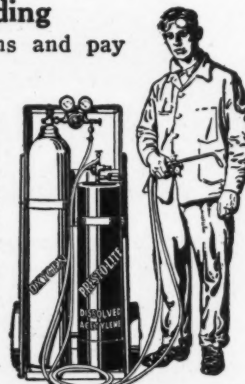
Savings made please your patrons and pay good substantial profits.

PREST-O-LITE

Dissolved Acetylene
(Ready-made carbide gas)

adds to the efficiency and usefulness of any good welding equipment. We furnish thoroughly high grade welding apparatus for \$80.00. The average user will also need gas cylinders at an additional cost, and about \$10.00 worth of welding supplies. Truck and special equipment for cutting operations at extra cost. Send for details of Prest-O-Lite Service for Oxy-Acetylene Welding.

The Prest-O-Lite Co., Inc.
The World's Largest Makers of
Dissolved Acetylene
233 Speedway Indianapolis, Ind.



HYATT

Roller Bearings

HEINZE

High Tension Magneto

Original in Design
Superior in Quality

HECO

Factories
Lowell,
Mass.

Branches
Chicago
1256 Michigan Ave.

Known
users
better



by all
as the
Magneto

HECO

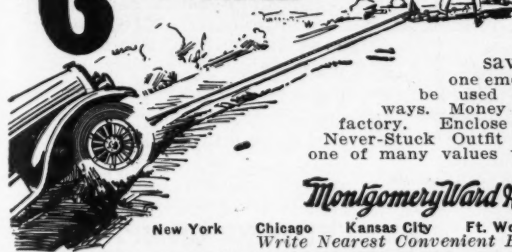
Sales Offices
Detroit
Mich.

Branches
New York
1876 Broadway

HEINZE, ELECTRIC COMPANY

Never—Stuck

Auto Puller
\$6.25 Complete Outfit



Pulls your car out of any hole or rut. Hook it to your front axle. You will save the price in one emergency. Can also be used in many other ways. Money back if not satisfactory. Enclose \$6.50 for one Never-Stuck Outfit complete. Only one of many values we offer.

Montgomery Ward & Co.

Dept. AC513

New York Chicago Kansas City Ft. Worth Portland, Ore.
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Detroit Plant for Sale

We offer the plant, known as the P. R. Manufacturing Company, located at 621 Bellevue Avenue, Detroit, Michigan, for sale.

The land has a frontage of 416 feet on Michigan Central Belt Railroad and on Bellevue Avenue. The depth is 183 feet. The location is one of the most desirable in the City on account of its railroad connection and its position in the center of a labor residential district.

Not quite one-fourth of the land is at present occupied by buildings, giving ample room for expansion. The present buildings (two-story) provide about 33,000 square feet of floor space, and are brick, mill construction, and equipped with sprinkler system.

For further particulars address

SECURITY TRUST COMPANY, Receiver

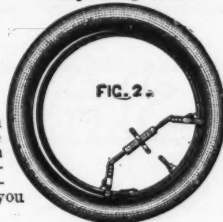
P. R. Manufacturing Company
 DETROIT, MICHIGAN

Contracting Rim



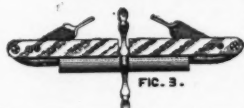
Change Tires in 2 Minutes

Expanding Rim



Don't wage war with your tires every time you try to remove them from the rims. No physical exertion is needed—and very little time, if you use a—

Niswander Tire Remover

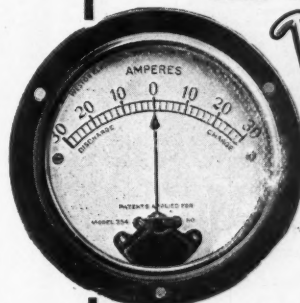


Specially threaded hand wheel contracts and expands the rim from 1 to 4 inches. Tire drops off when contracted. As easily replaced. Guaranteed to work on any straight side split rim. Folds to pocket size. Write for free illustrated literature, or send \$2.50 for device by prepaid parcel post. Special proposition to salesmen.

Remover Folded Pocket Size

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Be Sure About Your Lights and Starting Motor!



Weston
 MODEL 354 AMMETER

On Your Dashboard or Cowl

you are never in doubt as to whether your battery is being properly charged. It indicates exactly, and at all times, the rate of charge or discharge of the battery, warning you before it is too late whether your battery is being maintained in the condition which will assure you perfect service. Write us—let us tell you about it.

Weston Electrical Instrument Co., 10 Weston Ave., Newark, N.J.
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INDIANA TIRES

Inner Tubes, Inner Liners, Outer Boots, Inner Sleeves, Blowout Patches, Cementless Patches, Cement Patches, Red Rubber Tubing

INDIANA RUBBER AND INSULATED WIRE CO.
 JONESBORO INDIANA

Provided with or without padlock.



Oakes Kranklock

Oakes Kranklock combination starting crank holder and lock and license holder. Make your car thief-proof with this handy and serviceable combination. It holds the starting crank rigid and license tag securely. Every Ford owner needs one. Can be put on easily in a few minutes. No holes to drill. Prevents garage employees from using or tampering with your car while in garage.

50c Without Padlock

\$1.00 with Special Padlock

Made by the makers of the famous Oakes Fan Beartone Fan-Horn, \$5.00

If your dealer is unable to supply you with any Oakes accessory, it will be shipped direct on receipt of price.

Write for complete description of our entire line.

THE OAKES COMPANY, Dept. C. Indianapolis, Ind.



Any man or woman can quickly learn to drive and anyone can care for his Ford car, and that's half the fun of motoring. Just the reliable, simple, useful car that meets everybody's requirements.

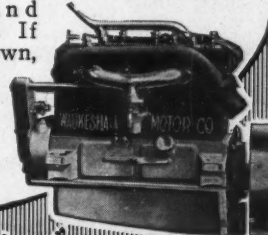
The price of the Runabout \$390; Touring Car \$440; Coupelet \$590; Town Car \$640; Sedan \$740.

FORD MOTOR COMPANY
 Detroit, Michigan

Waukesha TRUCK MOTORS

noted for their battle-ship strength and aeroplane lightness. If you manufacture, own, operate or expect to buy a motor truck, write for catalog M which gives full details.

Waukesha Motor Co.
 221 Factory St.,
 Waukesha, Wis.



The Exceptional Motor

Repair Tires—Make Money

Don't continue to plod along and be content with just a storage business with occasional sale of gasoline and oil. The garage that is making money today is the one that is vulcanizing tires with a

SHALER VULCANIZER

You don't have to go out and solicit business. The auto owner when he comes to you for supplies, gasoline, oil, etc., and knows you can repair his tires, will give you the job. Give your customers this complete service they like, be ready to repair their tires, make money for yourself.

Anybody who can clean or adjust a car can operate a Shaler because of the simplicity of Shaler Wrapped Tread Method and Automatic Heat Control.

Catalog Free Send at once for the new Shaler catalog, the most complete Vulcanizer Catalog ever published. Get the low discount price for the Shaler garage type pictured here. We will also send you our book "Common Sense about Tire Repairs" for garages only.
C. A. SHALER & CO., 229 Fourth St., Waupun, Wis.
The Largest Manufacturers of Vulcanizers in the World



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INVENTED BY G. F. LONG

"Always Warns"

The ONE perfectly made—the highest priced mechanical horn. Pleases user and doubly satisfies dealer. \$5 Retail. Send for our new 1916 Sales Plan.

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"Tells the Motor's Secrets"

Manufacturers
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For Cleaning Automobile Bodies



Garagemen find it cheaper to use than soap and water—cheaper and infinitely more satisfactory to their customers.

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Combination Tires

The "Hold-On" Tread are as superior in quality to ordinary tires, as the Combination liberal sales policy is superior to the "cut and dried" ordinary selling policy under which the ordinary tires are sold.

Get the exclusive territory proposition.

The Combination Rubber Mfg. Co.

Manufacturers of High-grade Rubber Products for 50 Years

BLOOMFIELD, NEW JERSEY

Write or Wire for Particulars Regarding Our Proposition



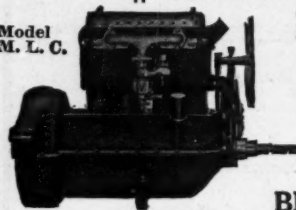
Passenger
and
Commercial
Car
Motors

Beaver Motors

Fit Every Demand

There are BEAVER Motors in a variety of sizes, suitable for all pleasure car and commercial car requirements. Meet all demands for power, economy and dependability.

Model
M. L. C.



Over-head valves. 20% to 25% more power than other motors of same bore and stroke.

Write today for BEAVER specifications before deciding on the motor to use

BEAVER MFG. COMPANY

4-Cylinder—4-Cycle

1st & Oklahoma Ave., Milwaukee, Wis.

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MAKERS OF SPRINGS & AXLES FOR OVER FIFTY YEARS

Scripps-Booth



Luxurious light cars which in their first season have found the way into America's and Europe's most refined society. Scripps-Booth stands out as the most attractive car in the roadster class. A car of beauty possessing comfort heretofore unknown in a motor car. Roadster, \$825—Coupe, \$1450—8-cylinder, four-passenger, \$1175 Dealers wanted.

Scripps-Booth Company
Detroit, Mich

KINGSTON IGNITION DEVICES

High and low tension magnetos, make-and-break coils, dash coils, box coils, motorcycle coils, switches, spark plugs and other ignition specialties. Guaranteed satisfaction

WRITE FOR CATALOG

KOKOMO ELECTRIC COMPANY, Kokomo, Ind.

In this hot weather use a lubricant that will not melt—use



Summer temperatures alone sometimes cause common grease to melt. Besides, grease melts at bearing temperatures, becomes too thin and leaks out, proving its unfitness as a lubricant for your car.

Non-Fluid **always** retains its original density, is **always** ready to lubricate and has 3 times as much lubricating value as grease.

Sold only in orange colored cans at your dealer's.

Write for samples and literature

NEW YORK & NEW JERSEY LUBRICANT CO.
165 Broadway, New York



Enjoy Drawing Room Luxury
When You Tour

CARRY

Kamlee Auto Trunks

Kamlee-Cadillac Fender
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Rain, dust and rust-proof. Protect fresh supplies of clean linen and extra clothes. Special KAMLEE-CADILLAC Fender Trunk includes 3 suit cases and a slip cover. Designed for use on Cadillac cars. Makes touring anywhere, comfortable as best railroad accommodations. There's a KAMLEE Trunk for every kind of car. Write for free catalogue.

Special discounts to dealers

THE KAMLEE CO. 444 E. Milwaukee, Wis.
Water St.



Will
Fit
Any Tire
On Any
Bracket
On Any
Car

Style D

We will send Water Bucket only
postpaid, for 50c

THE MARTIN MANUFACTURING COMPANY
LANCASTER, OHIO

Special
Introductory Offer

For \$2.00, cash with order, we will send you a Style "D" Martin Tire Cover, any size up to 37x5 (if over 37x5 add 50c), also a Martin Water Bucket, price 50c, and a pair of Knock-a-bout Gauntlet Gloves. All postpaid anywhere in the U. S. A. for \$2. All we ask you to do is to show your dealer.



DEALERS: Send for our Booklet

The Reason Why **Standard Trucks** are "ALWAYS ON THE JOB"

Because:

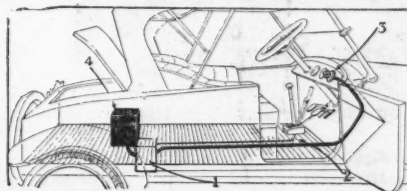
All Standards are Standard-ized

With a standard motor—Continental; standard axles—Timken; a standard transmission—Brown-Lipe; standard bearings—Timken throughout; standard everything at a standard price so you take absolutely no risk in your selection of a STANDARD TRUCK—all capacities.

Write Dept. 7 for the most liberal agency proposition ever offered.
Standard Motor Truck Company, Detroit, Mich.

Beware of Auto Thieves

Equip Your
Car with
**Arnold
Auto Alarm**



1. Bell. 2. Cable to brake. 3. Lock on dash. 4. Battery.

Saves 25% on Your Insurance

not be stopped. Install it yourself. Full direction with each outfit.

Attractive Proposition to Dealers

ARNOLD & ARNOLD, 501 Rush St., Chicago, Ill.

Guaranteed Theft
Proof. Electric
bell rings if car
is started. Can
not be stopped.

Draw Trade Your Way

by installing a Curtis Air Compressor in your Garage or Service Station. Motorists look for a Curtis Outfit because it gives them clean air, free from oil—and will appreciate your efforts to save them many dollars upkeep on tires.

**CURTIS AIR
Free From Oil**

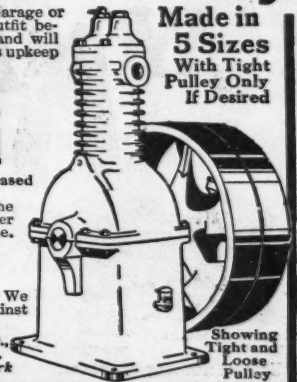
means fewer blowouts, fewer punctures, increased mileage, less repairs for your customers.

Install a Curtis Air Compressor NOW. It is the only one so designed that it can't flood the cylinder with more oil than it can use. No oil gets in air line.

**5 Sizes—125 Combinations
At Attractive Prices**

Write for full particulars and our proposition. We can show you how to get and hold business against keen competition and "cut prices." Write today.

CURTIS PNEUMATIC MACHINERY CO.
1527 Kienlen Ave., St. Louis, Mo.
Branch Office: 530H Hudson Terminal, New York



Made in
5 Sizes
With Tight
Pulley Only
If Desired

Showing
Tight and
Loose
Pulley



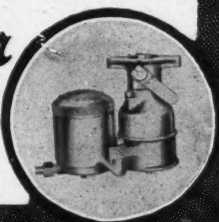
Barney Says

"MILLER Carburetor is a wonderful instrument. It is simply perfect." Barney Oldfield knows. He broke the world's mile track record using a MILLER.

Miller Carburetor

Put a MILLER on your pleasure car or truck and it will start making economy, power and acceleration records for you. Write for circular. Dealers wanted.

Miller Carburetor Sales Corp.
834 S. Los Angeles St., Los Angeles, Cal.
Chicago Office: 2526 Michigan Ave.



Not made to meet a price, nor to shatter records of quantity, but to fulfill a service ideal—to be a true foundation for a worthy motor vehicle.

CONTINENTAL MOTORS COMPANY, Detroit, Mich.

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EVENLITE



Over 20,000 Evenlites are in use on 1915-16 Ford Cars and every user is delighted. They Sell Anywhere—Everywhere they're offered.

EVENLITE	\$4.00 to \$6.00
BATTERY CHARGERS	\$24.00 to \$140.00
ST. LOUIS MAGNETIZERS	\$7.50
ST. LOUIS MAGNETO TESTERS, show the trouble instantly	\$10.00

Write For Our Catalogue.

ST. LOUIS ELECTRICAL WORKS, 5403 Easton Ave., St. Louis, Mo.

Steel Tires and Mud Chains



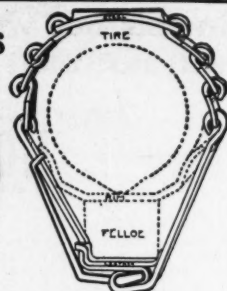
Old Tires
Covered
Complete



NO MORE PUNCTURES

Try 2 or 3 sections over any old blowout. Can't have blowouts, punctures; neither can the rubber wear off.

Special prices to those in new territory



Anti-Skid

Mud chains can be put on in a jiffy with one hand while standing on the running board. Hook the ends together and push the little lever. If you get in a mud hole you will laugh out loud.

Kimball Tire Case Co., 173 Broadway, Council Bluffs, Ia.

SPARTON Safety Signals

Have the far-reaching call for country roads—the quick, snappy shriek for city traffic. Use the Sparton on your car.

The Sparks-Withington Co.,
Jackson, Michigan



Model
"F" \$4

finished in
satin black
and nickel or
all black.



Timken
Axles and
Roller Bearings
10,000 Mile Tires

MATCO TRAILERS

MATCO trails as well behind a Ford run-about as a 5-ton truck. Built in any type body, to suit the requirements of every car owner. Write for illustrated catalog with complete specifications. Liberal dealers' proposition.

The Michigan Auto
Trailer Co.
DETROIT, MICH.



Mr. MANUFACTURER:

MAXIMIZE YOUR EXHAUST

That the most wonderful of all noise-reducing inventions is the *Maxim Gun Silencer*, is now recognized the world over. Now, in the

MAXIM AUTO SILENCER

this principle is adapted to the automobile exhaust. To be up to date a car should be equipped with a Maxim Auto Silencer instead of the old-fashioned muffler with wasteful baffle plates, tubes and holes. We can handle a limited number of quantity contracts. Manufacturers; ask for information.

THE MAXIM SILENCER CO.
111 HOMESTEAD AVENUE HARTFORD, CONNECTICUT

HIRAM PERCY MAXIM
President



22-72 Touring
22-72 Sporting
22-72 Runabout
22-72 Raceabout

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800 Whitehead Road Trenton, N. J.



ZENITH CARBURETOR

KNOWN the world over as the zenith of simplicity and efficiency.

A precision instrument giving permanently, exact carburetion for your car.

Zenith Carburetor Co.
Detroit, Mich.

Kissel's
Ultimatum to the
Automobile World—

The Hundred Point Six
\$1095

The Big Value in Sixes—Get the details now
KISSEL MOTOR CAR CO.

121 Kissel Avenue

Hartford, Wis.

KISSELKAR
EVERY INCH A CAR

THE CLEARING HOUSE

of the Motor Car Industry

For Used Cars, Parts, Accessories, Supplies, Tires, Repairing, Machinery and all other Special Announcements of a Similar Character

ADVERTISING RATES: 1/4 inch—One time, \$2.40. Three times, \$5.85. 1 inch—One time, \$4.50. Three times, \$10.80. 1 1/2 inches—1 time, \$6.75; 3 times, \$16.20. 2 inches—1 time, \$8.75; 3 times, \$21.00. Special rate for other spaces and longer terms on request

CAR OWNERS

HIGH GRADE SERVICE FOR LESS MONEY

Do you know why we make this statement and how we can fulfill it?

We are the largest concern in the world supplying repair and service parts to car owners. We buy defunct automobile companies. Repair parts are received in trainload lots. To date we have purchased over one hundred automobile companies. There are over TWO MILLION service parts for all makes of cars in our large warehouses. Our customers are receiving the direct benefit of our wonderful purchasing power.

Below is a partial list of Orphan Cars for which we supply prompt and efficient service.

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Michigan Warren Speedwell

Anhut
Barnes
Benham
Century
Crescent

Cutting
DeLuxe
Demot
Elmore
F. A. L. Car
Grabowsky

Havers
Keeton
Marquette
Northern
Ohio
Owen
Rainier
Reliable-Dayton
Scripps-Booth Cycle
Wayne
Welch-Pontiac
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If Your Car Is Not Listed, Write Us.

Our Service is the highest grade. Orders receive prompt attention. Shipments made promptly.

Send us an order today for repair parts for your car. We can supply practically any part for any car and our prices are the lowest.

If you do not see listed what you want, send for our large illustrated Bargain Bulletin. It is free upon request.

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Abbott-Detroit Model 34-40	\$35.00
Abbott-Detroit Model F	35.00
Studebaker Model 25-35	20.00
Studebaker 6 Cyl., 1913-14	25.00

Transmissions

Center control Keeton transmissions with shaft lever ..	\$50.00
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Miscellaneous

Demountable wheels, all makes and sizes; per set, with extra rim	\$21.50
Springs for most any car; each, up from	3.00
Right and left hand steering gears, up from	10.00
Tops for any make of car; price up from	15.00
Rob Roy Shock Absorbers for Fords (Set of 4)	4.00
Electric spot lamps, each	2.25
Deaco permanent magnet lighting generators with cut-outs, each	10.00
Rims, all sizes and makes; each	2.30
Windshields—All models and sizes—up from	7.50
Fenders—Many sizes and types—each	3.00
Bodies—Latest models complete—prices up from	50.00
Gas Tanks—All sizes and types—up from	1.00
1914 Touring Bodies with tops for Ford	25.00
\$25.00 Stewart Speedometers, Flush type head, complete ..	9.00
Small repair kits; great for the auto	1.19
Wire wheels complete with hubs, drums, caps, etc., per set of 4	100.00

Space will permit listing only a few of our many bargains. Write for our large illustrated Bargain Bulletin of auto supplies. It is free upon request and will positively save you money.

Puritan Machine Company

ALL PARTS FOR ALL CARS

410 Lafayette Boulevard, Detroit, Michigan, U. S. A.

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Cars---For Sale and Wanted

Late Model, 5-Pass., 4-Cyl. Cole

Fully equipped in every way. A bargain.
CONDON
2635 Wabash Ave. Chicago
Calumet 5311

Matheson

Cars and Repair Parts

FRANK F. MATHESON, Wilkes-Barre, Pa.

"Parlor Car"
Passenger^{High}Way Coaches
25 INDIVIDUAL CHAIRS

"PULLMAN" CAR COM-
FORT AND LUXURY AT
COMMON BUS PRICES

W. H. MARSHALL

866 Peoples Gas Building Chicago

\$250 TAKES 1912 PREMIER 4-40 5-PASS.
touring car with complete equipment, includ-
ing speedometer. (No. 912). Ask for bulletin of
other cars.
PACKARD MOTOR CAR CO. OF CHICAGO
Michigan Ave. and 24th St., Phone 4316 Calumet

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THOMAS T. GRAY

Research Chemist and Petroleum Engineer
Specializing in the examination of Gasoline
Lubricating oils and Petroleum Products.

MANUFACTURING AND RESEARCH
LABORATORY

1853 North Ave. Elizabeth, N. J.

Flying Machines

NO HIGH WAR PRICES

One standard low price to all made possible
only by long experience, careful buying in quan-
tities and wonderful efficiency. Save time by
being supplied from America's oldest and largest
manufacturer. Most complete stock in the world.
Get our catalogues; they tell. Aeronautical sup-
ply 6, Motor 4, and Propeller 3 red stamps.

E. B. HEATH AERIAL VEHICLE CO.
CHICAGO

Garages, Shops, Etc.

FOR SALE AND WANTED

—FOR SALE—

Automobile Garage in Central Illinois City
of 9,000 population. County seat. Limited com-
petition, complete accessory stock, storage sale,
repair and electric charging business. New
brick (fire-proof) building, 50x150, with truss
roof construction. An unusual opportunity for
responsible party at reasonable terms. Address

Address E 541, Care Motor Age

—FOR SALE—

Best garage in good Iowa town of 1200 fully
equipped with small stock of accessories, owner
has other business.

Address Box E 547, c/o Motor Age

—FOR SALE—

Fully Equipped Machine Shop and Garage
Terms to suit purchaser
Address Box E 543, c/o Motor Age

—FOR SALE—

In order to hold territory on a popu-
lar car must sell a branch house
and establish a purely sales branch
in another town. This fine paying
Garage and Sales business in Mon-
tana town of 4500 (only two gar-
ages in town). Must be sold soon.

Address Box E 544, Care Motor Age

FOR SALE OR TRADE

for Central Northern Property. Auto Machine
and Model Work, one of the best prominent
magneto service stations in the South. Busi-
ness been established and a big paying propo-
sition. Photo and description on request. Ad-
dress 1014 McKinney Av., Houston, Texas.

FOR SALE—The only vulcanizing plant in
county having 1170 automobiles, situated at
county seat, on paved street, near the square.
Concrete building rents for \$12.00 per month.
Will sell everything at invoice price. Must sell
on account of poor health. Address LEO R.
BROWN., Aurora, Neb.

Garage and Machine Shop

Only one in town of 1500, on main road; doing
good business. Good reason for selling. Build-
ing 50x100. \$3500 will buy. No rent to pay.
Address Box E 545, care of Motor Age

Help & Situations Wanted

Factory Representatives
Wanted—

High grade men to represent a high
class line of worm drive trucks.
State experience and territory
covered.

CADILLAC AUTO TRUCK CO.

Cadillac Michigan

POSITION WANTED

REPAIRMAN—Experienced on Fords and gas
cars in general. Eight years. Married, sober
and reliable. References.

Address Box E 546, care of MOTOR AGE

SALESMEN

Get our plan for monogramming autos, etc., by
transfer method. These Monograms are dur-
able, artistic, easily put on and very profitable.
MOTORISTS' ACCESSORIES CO., Ashland, O.

WANTED—AGENT OR DEALER

in every town and locality for quickest selling

AUTO NECESSITY

Every auto owner needs one or more. Every-
body buys it on sight. Act quickly before the
agency in your locality is gone.

Write for FREE circulars and information. A
sample sent on approval.

PHILLIPS MFG. CO.

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Machinery

CHARGING GENERATORS
FOR SALE

Battery Charging, Set Mounted on Iron Base
and Driven by 5 H.P. Alternating Current Mo-
tor Complete with Switch Board and Meters.

INDUSTRIAL MACHINERY EXCHANGE

90 West St. New York City

Magnetos---Service Stations

A BAD SPARK IS ANNOYING

Send your magneto to us for quick service.
We repair magnetos, coils, starters and storage
batteries.

EMEIS MANUFACTURING CO.

217-221 Iowa St. Davenport, Iowa

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All Makes Magnetos and Everything
Electrical Repaired by Experts

Quick Service. Magnetos Bought, Sold
and Exchanged.

MOTOR CAR SERVICE CO.

IGNITION SPECIALISTS

524 E. 35th St. Chicago, Ill.

ALL MAKES

of Self Starters, Batteries, Magnetos
REPAIRED

Let our factory-trained electricians take care
of your electrical troubles. Our low prices and
high-class mechanics give us the business.

Special Prices for Dealers

KANSAS CITY BATTERY COMPANY
1607-11 Grand Ave. Kansas City, Mo.

Always before you spend money on Ignition or
Lighting, Repairing, "Try Us and Be Convinced."
Expert repairing, Magnetos, Armatures and
Fields rewound. CHICAGO MAGNETO EX-
CHANGE, 2333 Mich. Ave., Chicago, Cal. 3954

Any Magneto, Generator or Starting
and Lighting System

most efficiently repaired by most modern plant
in the West; a house of Established Reputation,
employing a staff of Trained Electrical Experts.
Most conclusive evidence is: 25 years of Square
Dealing in this business. Only Official Service
Station in Chicago for Westinghouse, Kemco,
Disco and U. S. L.

ARTHUR JONES ELECTRIC CO.

57 East 28th Street Chicago, Ill.

BRING US YOUR

Electrical Equipment
Troubles
TO SET RIGHT

If your battery, starter or magneto gives
you trouble, trained specialists can find
the reason in our thoroughly efficient
service station. The result of years of
study and experience with every elec-
trical appliance for motor cars.

Our battery department is in charge of
experienced workmen, and gives prompt
service on all jobs.

Trained men also are at the head and
benches of the magneto and starting de-
partment, to give you the benefit of
highest grade service.

Every job is thoroughly tested before
delivery.

Official repair shop for

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—but we repair anything electrical, if it
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LARGEST MAGNETO WRECKING HOUSE
IN THE MIDDLE WEST

We have new and used parts of any Magneto
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profit. Our big business justifies this. Write
for our weekly Bargain List in new and used
Magnetos and Coils. 200 Bosch Magnetos, all
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Anything to make the spark,
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EXPERTS: LIGHTING AND STARTING
Official service station of Elsemann Magneto Co.,
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Expert Repairing and Overhauling of
all kinds and types of Magnetos and
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ALL WORK ABSOLUTE GUARANTEED

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Carry complete stock of DELCO and ATWATER-
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MAGNETOS BOUGHT, SOLD AND REPAIRED
Send your ignition system to us. We repair and
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MAGNETO BARGAINS

Bosch 2 cyl. M. C. Type.....	\$14.00
Bosch D. U. 4 Type.....	30.00
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Bosch D. U. 6 Type.....	40.00
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Any part for almost any magneto at half
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Magnetos, Low Tension from \$5 up. High Ten-
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ALL OUR WORK GUARANTEED

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Magnetos, Coils, Lighting Generators

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Automobile Specialists in Ignition, Starting and
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INDUSTRIAL ENTERPRISES

seeking new or more commodious
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factory sites still available at low
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tary, Advancement Association,
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als will be received at said office until ten a.m.
June 28, 1916, when bids will be publicly opened
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A well equipped machine shop wants machine
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Address Box E 542, Care Motor Age

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GREATEST BARGAINS IN

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Underwoods, \$30; L. C. Smiths, \$27; Reming-
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Every machine in perfect condition and guar-
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3—Delco Systems, 1916, Wiring diagrams easily
understood; price 25c. Book No. 4—Contains
wiring diagrams and explanations on 19 prin-
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TRIC SYSTEMS PUB. CO., 400 U. B. Building,
Dayton, Ohio.

UNIVERSAL AUTO RECORD BOOK
Record Sheets for: Specifications, Purchases, Re-
pair accounts, Casing, Mileage, Motor Trips,
Monthly and Yearly Expenses, Memorandums.
Price 50c.
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Touring Car Bodies.....	\$10.00 to \$60.00
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New G-4 Elsemann Magnetos.....	\$33.75
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Rebuilt Hudson "54", A1 condition.....	25.00
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We make radiators for any car.	
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40 H.P. Wisconsin complete, \$125; Continental
40 H.P., \$100; 40 H.P. trans., center or side
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and up; radiators, bearings and parts; Presto
tank, full, \$10.

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ALL SEASON'S RECORDS MADE WITH
Schebler equipment. Why not get a Schebler
Model R for your car? Our exchange propo-
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Parts and Repairs from All Models

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Everready Automatic Engine Starter. General
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Welding of all metals. Manufacturer Catelain
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Franklin 6, \$60.00; E.M.F., \$45.00; Buda Motor,
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Other parts low price

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West End Pittsburgh, Pa.

Automobile Parts

SAVE 50%

We have Wheels, Axles, Gears, Bearings,
Cylinders, Pistons, Crankshafts, Camshafts,
Crank Cases, Transmissions and Hubs.

Complete Rear Axles.....\$20 to \$65
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WE HAVE PARTS FOR MOST ALL STANDARD
MAKES OF CARS. WRITE US YOUR NEEDS.

E M F 30	Buick Models 10 & 17
Chalmers F & 38	Oakland 1910
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Maxwells Q.F.K.G.&AA	Cadillac 1909 to 1912
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Courier & Marion	Interstate
Overland, 38, 42, 53	Marmon 1909
Chase Truck	Flanders 20
Packard 1906 to 1909	Cole 30
Henry & Franklin	

COMPLETE ENGINES

Marion 1910	\$ 90	Cadillac 1909	\$ 85
Excelsior	90	Overland 38	75
Packard 1908	150	Mitchell 1909	60
Flanders 20	75	Amplex	85
Overland 42	75	Buick Model 10.....	100

Will sell most any part from these engines. We
have a large stock of engines and will trade engines
with you.

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4116 & 18 OLIVE ST., ST. LOUIS, MO.

No connections with any other Auto Parts Co.'s

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Built, Recovered and Repaired

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FROM USED CARS

100 different types in stock
Motors from 3 to 90 H. P.
Prices from \$8.00 to \$275.00
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Automobile Parts

We have them for all cars listed below, and many more. You save from 50% to 75% of manufacturers' listed price.

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Studebaker—Garford Maxwell, all models
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Dorris, 1906 to '09 Pierce Arrow '07 to '09
Peerless, 1906 to '09 Ohio—Paige 25
Stoddard Dayton Bergdoll-Staver
Reo—Stevens Duryea Kirt 20—Atlas
Midland-Wayne-Weich Overland 37, 38, 42, 54, 59
Nyberg—Speedwell Mitchell 1908 to '13
Stearns, 30 to 60 Thomas, all models
Kissel 6—Matheson Great Western—R.C.H.
Amplex, all Models Commerce Truck
Regal—Parry Oldsmobile Special Ltd.
Popotoledo Autocrat Defender
Oakland—Seldan American Underslung, 30
Interstate-Jackson to 50
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Bosch high tension, straight system...\$25.00
Bosch Dual, with coil...\$32.50
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AXLES—Timken full-floating, complete with drive shaft, hub and drum, all sizes...\$60.00
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GOOD MOTORS—COMPLETE

Packard, big 4-30, complete with magneto and carburetor...\$160.00
Continental, 30-40-60...\$75.00 to \$150.00
Studebaker...\$60.00 up
Overland...\$50.00 up
Moon 30-40...\$75.00 to \$100.00
WE SELL ANY PARTS FROM THESE MOTORS, transmissions, rear axles, etc. We have cylinders, piston rings, cam and crank shafts, crank cases, transmission cases, steering posts, wheels, rims, and many other parts.

Maxwell Bros. Auto Salvage Co.

3931-33 Olive Street St. Louis, Missouri

AUTOMOBILE PARTS

6-Cyl. Thomas motor cheap; 4-Cyl. Kirt unit power plant complete, \$100; E. M. F. motor parts; 3 speed transmission center control, \$35; B Presto, \$9; 50 H.P. Stoddard-Dayton engine, \$100; Splittorf and Remy magnetos, \$12.50 each; \$35.00 motor driven Klaxon horn, \$10.00; Atwater Kent ignition system for Ford, \$15. We carry parts for a number of different model cars. Write us, giving description and measurements of parts wanted.

BOSCH MAGNETOS, ALL MODELS, \$25 UP

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AUTO TOPS—\$15.00 and up.

SEAT COVERS—\$4.00 and up, per set.

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Recover your own Auto Top and save money. We furnish complete outfits for all makes of cars ready to slip on.

SPECIALS FOR FORDS—Complete

Runabout roof and back...\$ 5.45

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Auto rubber One-Man Top with Jiffy curtains... 22.00

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American Auto Top Mfg. Co.

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At a saving of 50%. Tires, accessories, transmissions, rear ends, etc., for the following cars: Stearns, Stevens-Duryea, Flanders, Lozier, Maxwell, E. M. F. Buick and Speedwell. **BOSTON AUTO PARTS CO.**, 1221B Dorchester Ave., Dorchester, Mass.

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FULL STOCK OF PARTS FOR

**MICHIGAN LOZIER
MORA DRAGON**

We maintain a complete stock of parts for the above cars

Philadelphia Machine Works

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Continental 44 unit plant, magneto and coil, \$150.00; Michigan unit 30 and magneto, \$125.00; Thomas 6-90 Bosch magneto, \$200.00; Stearns 60, \$100.00; Bosch D4 dual with coil, \$35.00; D. U. 4 dual and coil, \$35.00; Elsemann 4 and coil, \$30.00; U. H. ind., \$17.00; Remy and coil, \$12.00; Splittorf and tubular, \$15.00; with box coil, \$12.00; New 9-in. brass swivel search lights, \$7.00; Timken axles, \$35.00 and \$50.00; new Stromberg carburetors, \$8.00 to \$8.00. Abbott, Speedwell, Thomas and a hundred other car parts.

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Auto Parts
Motors, from 1 to 6 cyl., \$12 up.
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for all makes of cars. TOPS recovered and repaired. Special One-Man Tops, Seat Covers. Cushions and Dust Hoods for Fords.

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Tops and Bodies Repaired or Made to Order

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1916 new Runabout and Touring Bodies complete with Tops and Windshield; Runabout \$40, Touring \$50; F. O. B. St. Joseph.
FARMER AUTO SUPPLY COMPANY
St. Joseph, Missouri

BARGAINS

You can't beat these prices! All material sold is guaranteed. Write or wire in your order and it will be taken care of immediately.

**—SPECIAL OFFER—
MAGNETOS**

Bosch DU-4 high tension...\$25.00
Sims-Bosch D-6 high tension... 32.50
Bosch D-4 high tension... 25.00
Elsemann 4-cyl. high tension... 15.00
Splittorf 4-cyl... 8.00
Remy 4-cyl... 8.00

COILS

Remy Box Coils... 3.00
Remy tube coil with switch... 4.00
Splittorf box coils... 3.00
Bosch coils... 6.00

PREST-O-LITE TANKS

Model E... 7.00
Model B... 8.00

MISCELLANEOUS BARGAINS

Gas headlights, per pair... 3.00
Chevrolet 1 1/4", several models... 3.00
18-gal. round, oval and square tanks... 4.00
18-inch steering wheels... 2.75

Write In Today. Bargains in Everything.

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Bosch Magnetos—D-4 \$25, D-R-4 \$27.50, D-6 and D-R-6 \$30. Bosch "A" coils, \$8. Guaranteed tires used 50 to 1,000 miles, all sizes, all makes, prices \$5 to \$25. Flisk bolt-on tires, sizes 30-3 1/2 to 37-5, \$5 to \$15. F. & S. and E. I. V. ball bearings, all sizes. All goods shipped C.O.D. with privilege of examination. **Hub City Motors Company, Park Sq., Motor Mart, Boston, Mass.**

When Writing to Advertisers, Please Mention Motor Age

BARGAINS

35 H.P. unit power plant Wisconsin T head motor, very high speed, price \$140.00. 22 H.P. bloc Continental L head motor price, \$85.00. Pierce Arrow rear axle, \$25.00; Bosch B4, like new, \$22.00; Bosch distributor with coil on same order as Atwater Kent, \$12.00.

Jackson Auto Salvage House

560 W. Jackson Blvd. Chicago

BOSCH MAGNETOS

\$25 to \$35—Other magnetos, \$8.00 to \$20.00
50% OFF LIST PRICE ON PARTS FOR ALL STANDARD MAKES OF CARS

Buick 10-17 Lozier
Overlands, 30 to 42 inc. Pope
EMF 30 Flanders Hartford
2 & 3 Speed Oakland 40 and 42
Maxwells, L. E. K. Franklin
and AB Jackson 50
Chalmers F. K. & N Interstate 40
Mitchell Six and T Velle 40
Studebaker-Garford Warren Detroit
Halliday Amer. Truck
Ohio 40 Marion
Stevens U Ramblers 40 and 50
Rear Axles, \$20 to \$50, including Weston-Motts, Amer. Ball, Smith, Stutz and many others—Full Floating. Transmissions: Warner, Brown & Lipe, Buick 17, Pope Hartford and Mitchell 4 & 6-cyl., \$25 to \$45. Planetary, \$15 to \$20.
Money cheerfully refunded if not satisfied

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BUCKET SEATS

SPRING CUSHIONS

Write for Prices

AUTO REMODELING CO.

1501 Michigan Ave. Chicago, Ill.

Buy Repair Parts from Us

WE CAN SAVE YOU MONEY

We have motors, transmissions, axles, Magnetos, everything at lowest prices.

TELL US WHAT YOU NEED

Cedar Auto Parts Co.

4800 Cedar Ave. Cleveland, Ohio

DO YOU WANT

Bargains in Auto Parts? Look over this list, then send for our complete 1916 Catalog.

MOTORS

Oswald, 30 H. P. \$100.00
Hirschell Spillman "T" head, 30 H. P. 100.00
Model 40 H. P. 100.00
Piggins, 4-cyl. 130.00
Everett, 6-cyl. 175.00
Many others in stock; send for complete list.

AXLES

F. A. L. semi-floating rear axle..\$ 45.00
Mitchell semi-floating rear axle.. 45.00
Front I-Beam... 25.00
Rear truck... 20.00
Set light car axles complete with wire wheels... 35.00

RADIATORS

Old ones repaired, new cores installed, or a complete new radiator at very lowest prices.

SUPPLIES FOR FORDS

Double ventilating cowl wind-shields...\$ 11.75
Crown fenders for Ford, per set.. 12.00
Master vibrator... 3.25
Streamline hoods... 5.00
Many other bargains.

MISCELLANEOUS

Stromberg carburetors...\$ 7.00
Schebler L 1 1/4" carburetors... 7.00
Rayfield D4 1 1/4" 7.00
D4 Bosch magnetos... 30.00
G4 Heinze waterproof... 30.00
2" channel bumpers, black or nickel... 4.00

We also handle bodies, tops, wheels, frames, transmissions, steering gears, etc.

—Don't Fail to Get Our Catalog—

AUTO PARTS CO.

740 W. Jackson Blvd. Chicago, Ill.

CARBURETORS

New 1 1/4-inch Stromberg A-2, B-4.....\$5.00
 New 1 1/4-inch Holley.....2.50
CITY AUTO TIRE & SUPPLY CO.
 E 24th & Chester Ave. Cleveland, Ohio

ENGINE BARGAINS

All with carburetors, magnetos and coils
 or will sell any part of the following:

Apperson, 40, 4-cyl. starter.....	\$175.00
Mitchell Six, 1914, Bosch ignition.....	145.00
Palmer Singer, 6-60.....	135.00
Chalmers "E," 40, Bosch ignition.....	125.00
Jackson 43, Unit Power Plant.....	125.00
Reutenber Six, off Herff-Brooks car.....	125.00
Buick 25C.....	100.00
E. M. F. 30.....	95.00
Buick 10.....	90.00
Reutenber 40.....	90.00
Overland 59.....	90.00
Overland 38.....	85.00
Oswald 4 Cylinder.....	80.00
Flanders 20, three speed.....	75.00
F. A. L. 4 Cylinders.....	75.00
1914 Saxon 4 Cylinder.....	75.00
Whiting 20, Unit Power Plant.....	75.00
Oakland Left Hand.....	75.00
Chase, 3 Cylinder.....	45.00

AUTOMOBILE PARTS

We have wheels, axles, pistons, connecting rods, cylinders, gears and bearings for the following cars:

Chalmers, F-K-L & M.	Hudson 20 & 33.
Buick, F-10 16-17-19 & 21.	Franklin—Prior to 1910.
Overland, 37-38-41-42-51-52-54 & 59.	Carter Car.
Maxwell, A-AA-D-Da-E-K-Q & Mercury & Mascotte.	Stoddard Dayton, F-H & K.
Winton, 4 Cyl. & 6 Cyl.	Black Crow.
Flanders 2 & 3 Speed.	Kline Car.
E. M. F. 30.	Carnation.
Studebaker 4-30.	Mitchell—T. & K.
Thomas Flyer.	Lambert—Friction Drive.
Great Smith—Both Models.	Cameron—4 & 6 Cyl.
Great Western.	Lexington.
Gleason—2 cyl.	Auburn.
Regal 30.	Glide.
Mitchell Six.	Royal Tourist.
Marquette.	For Fords—N-R. & S.
	Mathewson Six.
	Welch.
	Kncx.

For many of the above listed cars we have complete rear axles, complete engines and complete transmissions.

Don't get the idea that this stuff is "Junk," "SALVAGE" means serviceable and "SALVAGE" is our middle name. Money cheerfully refunded on any parts you order from us that you return as unsatisfactory or that you cannot use.

**These Parts Cost You Just Half of
 Manufacturers' List Price**

We also buy old autos that still have serviceable parts in them—but we prefer to buy wrecked late model stuff. Tell us what you have.

Auto Salvage Co., Inc.
 1416-18 Main Street
 KANSAS CITY, MO.

FORE DOORS

WE HAVE PATTERNS FOR ALL MODELS
 AND CAN MAKE PROMPT SHIPMENT AND
 GUARANTEE DOORS TO FIT.

HOODS TANKS SEATS FENDERS

MAREMONT MFG. COMPANY
 Chicago, Illinois

FOR SALE

350 watt motor generator sets, starts from supply or from batteries. Charges 3 to 15 cells, with ammeter, rheostat, and battery and supply switches on panel. Operates on 110 or 220 volts, 60 cycle supply. Will guarantee. Address

Ellington Electric Company

Quincy, Illinois

GEARS AND PARTS

FOR

Packard :: Chalmers :: Regal
 Piston Pins in stock for all makes of cars

Auto Parts & Accessories Co.

1933 Broadway New York

A Warning To Krit Owners— And Others

EVERY once in a while some so-called parts company is overcome with a boundless but misdirected ambition to expand its business. In these times ethics are entirely forgotten.

Such a condition now confronts us.

Advertisements have recently appeared in which certain concerns have purported to supply a full line of Krit repairs. One concern even asserted that it had purchased the Krit Motor Car Company and was now furnishing replacement parts from original patterns.

We therefore issue a warning to Krit owners against the misleading statements which have appeared. The warning applies as well to those who have made these statements. In the future we will take prompt and decided legal action whenever and wherever like offenses occur.

Here are the true facts:

The Krit Motor Car Company is still in operation and will continue in operation indefinitely.

The Krit Motor Car Company has sole possession of all its own jigs, dies, tools, patterns, forms and the engineering records from which its parts are made. It is absolutely impossible for any other individual or company to have access to them or to furnish Krit repairs with any degree of accuracy.

Further, the Krit Motor Car Company alone is obligated to Krit owners. Our service consists not only in supplying repairs but also in furnishing counsel and assistance in the operation and care of every machine.

From now on we propose to render this service undisturbed by unfair competition.

Krit Motor Car Co.

Detroit, Mich.

When Writing to Advertisers, Please Mention Motor Age

MR. AUTO OWNER!

**TAKE ADVANTAGE OF THE GOOD OLD SUMMER TIME.
DON'T KEEP YOUR CAR TIED UP WAITING FOR PARTS.**

PARTS ARE WAITING FOR YOU

We can fix you up complete on all used parts and accessories. Tell us what you need, and we have it in stock. All orders filled on short notice. The following we list for immediate delivery:

Parts for

Maxwell 2 cyl., all models
Maxwell 4 cyl., q and G.A.R.
Buick 10 and 17; Hupp 20
Rambler 44 and 54; Peerless 1907 and 8
Pope, Toledo, Elmore, Mora, Dragoon
Winton 6 x.y.z.; Jackson 1911; Mitchell 1910
Garford G, 4-6 and 8; Stevens Duryea M, U
Matheson; Michigan 1911
Overland models 42-49 and 69

Motors

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113.....	2554
104.....	3-F
492.....	375
311.....	375
251.....	3151
107.....	316
117.....	256
85.....	236
201.....	1550
35.....	3-F
9.....	3-I
39.....	2652
86.....	1956
62.....	2750
27.....	1954
51.....	1551
16.....	2551
414.....	336
275.....	456
69.....	337
98.....	2356
69.....	2-E
79.....	3438
380.....	317
40.....	317
271.....	2654
247.....	3392
33.....	3955
61.....	395
142.....	3420
270.....	10-J
100.....	3920
114.....	5556
18.....	3351
75.....	476
10.....	3360
48.....	5355
70.....	5351
70.....	4550
82.....	4361
124.....	6354
3.....	455
24.....	456
10.....	435
2.....	6450
22.....	6552
5.....	5550
5.....	350
1.....	6350
4.....	5357
2.....	5354
40.....	3350
40.....	3750
15.....	355
180.....	336
130.....	341
45.....	443
182.....	3520
141.....	5320
61.....	4520
2.....	6420
104.....	5520
120.....	6321
28.....	4320
77.....	474
22.....	6521
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3.....	6320
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P. BRADY & SON CO.

Trucking and Storage. Automobiles and Bodies Stored. Automobiles boxed for export.
552-558 W. 58th St., New York
Telephone 3440 Columbus

Supplies and Accessories

Absolutely Guaranteed

FUEL REDUCTION 'KARBONOID'

will do it

or Your Money Back

The Autocar Sales and Service Co. of Boston; Lenox Motor Car Co. of Hyde Park, Mass., and many others are saving 6c to 10c per gallon, are eliminating CARBON with the resulting increase in motor efficiency.

Sold in the following sizes:

75c	\$1.00	\$1.25
Treats	Treats	Treats
90 Gals.	135 Gals.	180 Gals.

Avoid substitutes and imitations; demand the genuine.

Dealers—Write or wire for available territory
NEW ENGLAND KARBONOID CO.
46 M Tennyson St. Boston, Mass.

ACTS LIKE MAGIC

Shadbroco the world's greatest cleanser and polish for automobile and furniture—new and different than all others. State and County Agents wanted at once. Big profits. Only small order required. Territory going fast. Write at once for details.

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2328 Michigan Avenue Chicago, Ill.

AUTO TOPS AND SEAT COVERS

Seat covers for all cars. We make new Tops and recover old ones. Handy Cocoa mat foot-cleaner for running board, \$1.50. **AUTOCAPE TOP COMPANY**, 2334 Michigan Ave., Chicago, Illinois.

Automobile Map of Your State, 10c

Our 1916 Catalogue Now Ready
Fred Allen Auto Supply Co.
1610 S. Michigan Ave. Chicago, Ill.

BIG BARGAIN BULLETIN

Watch Our Bargain Bulletins Issued in
This Paper Every Week

We are the World's Largest Automobile Supply
House—Buy from Us and Save Money

THIS WEEK'S SPECIALS ARE:

Mecca 8 Day Cowl Dash Clock.....\$2.60
Handsomely designed and finely finished in
black; an excellent timekeeper.

Jack No. 15.....\$1.10
Made of solid steel; noted for its simplicity;
one of the most practical on the market.

2-Inch Channel Bar Bumper.....\$4.80
Can be easily attached to any car; bar is hand-
somerly finished in nickel; fittings are black
enameled.

Stewart Vacuum System.....\$7.75
This system will save each month in gasoline
its original cost. Can be installed in any car.

Spring Leaf Spreaders.....\$0.25
Fits any size spring; makes it possible to thor-
oughly lubricate each leaf.

Style "C" Handy Tire Tool.....\$0.14
One of the most satisfactory tire tools made.
Used with any type clincher or Dunlop casing.

Triple Action Tire Pump.....\$3.50
Powerful, compound, quick-acting, labor-saving
pump. Most satisfactory in emergencies.

J & B Master Vibrators for Ford Cars..\$3.95
Specially made for Ford cars. Increases power
of engine and makes starting easy.

Oil Gauge for Ford Cars.....\$0.18
A most useful accessory for Ford cars; very
easy to attach

Robe Rail for Ford Cars.....\$0.25
This rail is especially made for Ford cars; inex-
pensive and durable

The above is but a partial list of our big bar-
gains. Send for a copy of our "Price Wrecker"
Catalogue, which shows and describes thou-
sands of supplies and accessories—everything
pertaining to the automobile.

SEND FOR A COPY OF OUR PRICE
WRECKER TODAY

TIMES SQUARE AUTO CO.
Largest Automobile Supply House in the
World

New York Chicago
56th St. & Bway. 1210 Michigan Ave.
Minneapolis Kansas City
Pittsburgh Cincinnati Philadelphia

DIFFICULT SOLDERING?

Use Burnley Soldering Flux—The paste form.
Sticks where you want it. Solder flows evenly
and quickly where this wonderful flux is used.
For radiator work—especially good. Anywhere,
all metals, except aluminum. Two sizes, 15 or
25 cents, prepaid. Use this once, you will have
no other.

BURNLEY BATTERY MFG. CO.
North East Pennsylvania

HAND-I-WASH

COMBINATION
WATER—SOAP—TOWEL
INDISPENSABLE TO THE

AUTOMOBILIST

Washing liquid and full roll of best quality, ab-
sorbent paper towels contained in handy recep-
tacle. Instantly removes dirt, grease and oil
without injury to the most delicate skin. Com-
pact—can be stowed in tool kit.

AT YOUR DEALERS \$1.00 Prepaid
OR DIRECT

Refiller complete, Towel, Roll and Tube of Liquid
Price 50c. Antiseptic and Sanitary.

TAY-MILLER MFG. CO., Inc.
Mfg. Chem., 1712 Cherry St., Philadelphia, Pa.
Special terms to dealers and agents. Write or
wire for territory.

—OLD TOPS MADE LIKE NEW—
and WATERPROOF by using RUB-R-TITE.
Easily applied, small car size, 60c; large car
size, \$1.00.

AUTO PRODUCTS MFG. CO.
40 Elm St. Buffalo, N. Y.

Paint Your Car Yourself

Save \$25 to \$75 by doing the work at
home with the Arsenal system. Our
big free booklet, "The Car Beautiful,"
tells how. Send for it today.

Arsenal Varnish Company
Auto Dept. Rock Island, Ill.

OVERSOLD!

Even though our plant is comparatively
small the capacity would not be reached
unless there was genuine merit in the
Vaporizer.

The H₂O Vaporizer is sold under the
guarantee to prevent carbon deposits, in-
crease power and lessen fuel bills.

Price \$10.

Orders will be filled in order received
as promptly as possible.

S. S. Hammond, Sales Director
1B Irvington Street Boston, Mass.

SPARE WHEELS FOR FORDS

Belt holders, axles, drive shafts—all for
Fords. Mfd. by ANGIERS, U. S. A.
Streator, Ill.

**WHY DON'T YOU SAVE ON
YOUR GASOLINE BILL?**

If you could be convinced that you could; un-
doubtedly you would have done so, before this
—but you were skeptical.

Will You Prove It to Yourself at
Our Expense?

SEND FOR A \$1.00 TUBE OF

C-A-R-B-O-N-V-O-I-D

which will treat 200 gallons of gasoline. If
after using 5 teaspoonfuls to 25 gallons you are
not convinced that you are getting from 5 to 7
miles more per gallon of gas, and that your
carbon deposits are disappearing, send back
the tube and we will cheerfully refund your
money.

Could We Do More?

CARBONVOID SALES CO.
215 B Parkman Bldg. Boston, Mass.

—WINKER FOR FORD—

Bright light at slow speeds or money refunded.
POST-PAID, \$1.50
THE WINKER MFG. CO., Bloomington, Ill.

\$235 Buys a standard make warn-
ing signal retailing through-
out the country at \$3.50.

We have 1000 signals in stock
10% Discount in lots of 12 or more. If you don't
think you are getting the best warning signal on
the market we will cheerfully refund your money

EATON & CO.

755 Boylston St. Boston, Mass.

30c—FAN BELTS FOR FORDS—30c

Just think of it—30 cents will buy one of
our special made fan belts for your Ford car.
Shipped promptly on receipt of order.

THE GEO. R. CARTER CO.
Connersville, Indiana

Tires**A SAVING FOR YOU**

In Standard Guaranteed and Used Tires

30x3.....\$4.50	\$ 6.00	34x4.....\$ 8.00	\$12.00
30x3 1/2... 6.00	7.80	34x4 1/2... 10.00	17.60
32x3 1/2... 6.00	7.00	36x4 1/2... 10.00	17.90
33x4..... 9.00	11.85	37x5..... 12.00	21.00

10% deposit with order, balance C. O. D. subject
to examination. Add 10% for Non-Skid Tires

SPECIAL

200 32x3 1/2 Straightside Plain Tread—\$6.75 ea.

WRITE FOR OUR PRICE LIST ON ALL
STANDARD GUARANTEED TIRES

ACORN TIRE CO., Inc.
1547 Michigan Ave. Chicago, Ill.

When Writing to Advertisers, Please Mention Motor Age

A BIG BARGAIN

in Regular Standard Guaranteed
3500 MILES TIRES and TUBES

— SHARE OUR PROFITS —

Size	Plain	Non-Skid	Tubes
28x3.....	\$ 6.35	\$ 7.00	\$1.75
30x3.....	6.95	7.45	1.85
30x3 1/2.....	8.95	9.50	2.05
32x3 1/2.....	10.30	10.85	2.20
34x3 1/2.....	11.50	12.15	2.25
32x4.....	14.10	14.85	2.75
33x4.....	14.05	15.45	2.85
34x4.....	14.95	15.75	2.90
35x4.....	15.55	16.50	3.00
36x4.....	15.80	16.60	3.10
35x4 1/2.....	20.80	21.85	3.75
36x4 1/2.....	21.10	22.15	3.85
37x4 1/2.....	21.85	22.95	3.95
37x5.....	24.90	26.25	4.50

**FULL LINE OF SLIGHTLY USED
ALL STANDARD MAKES TIRES AND TUBES**

Size	Tires	Tubes	Size	Tires	Tubes
28x3.....	\$3.25	\$1.00	35x4.....	\$7.25	\$1.75
30x3.....	3.50	1.25	36x4.....	7.25	1.75
30x3 1/2.....	4.25	1.35	34x4 1/2.....	7.50	1.75
32x3 1/2.....	5.00	1.40	35x4 1/2.....	7.75	1.80
34x3 1/2.....	6.75	1.45	36x4 1/2.....	8.00	1.80
31x4.....	6.00	1.50	37x4 1/2.....	8.50	1.85
32x4.....	6.50	1.45	35x5.....	9.00	1.90
33x4.....	6.75	1.65	36x5.....	9.50	1.95
34x4.....	7.00	1.60	37x5.....	9.50	2.00

Tires shipped C. O. D., subject to examination,
on receipt of \$1.00 for each tire.

ARMSTRONG TIRE & VUL. CO.
1614 Michigan Ave. Chicago, Ill.

A BIG SAVING IN**Tires & Tubes**

All Fresh Selected Stocks —
Standard Firsts—Guaranteed

The quality and service features in
these tires and tubes are the same
as featured in the tires you are now
paying high prices for. The follow-
ing price list buys fresh selected
stock that is positively guaranteed.

Size	New Tires	New Tubes
28x3.....	\$ 6.00	\$1.25
30x3.....	6.50	2.00
30x3 1/2.....	8.00	2.25
31x3 1/2.....	8.50	2.50
32x3 1/2.....	9.00	2.50
34x3 1/2.....	9.50	2.55
36x3 1/2.....	10.75	2.75
31x4.....	11.75	2.90
32x4.....	12.50	3.20
33x4.....	12.75	3.25
34x4.....	13.25	3.35
35x4.....	13.50	3.45
36x4.....	14.00	3.50
34x4 1/2.....	16.25	4.00
35x4 1/2.....	17.00	4.15
36x4 1/2.....	17.50	4.25
37x4 1/2.....	18.00	4.35
35x5.....	17.50	5.00
36x5.....	18.50	5.00
37x5.....	20.00	5.20

Add 10% to the above prices for
non-skid.

**Special Bargains in Slightly Used and Demon-
strating Tires**

Size	Used Tires	Used Tubes
30x3.....	\$ 3.50	\$1.35
30x3 1/2.....	4.25	1.45
31x3 1/2.....	4.50	1.50
32x3 1/2.....	5.25	1.50
34x3 1/2.....	5.50	1.60
31x4.....	6.25	1.65
32x4.....	7.00	1.60
33x4.....	7.25	1.70
34x4.....	7.75	1.70
35x4.....	7.50	1.75
36x4.....	7.50	1.75
34x4 1/2.....	8.00	1.75
35x4 1/2.....	8.00	1.80
36x4 1/2.....	8.25	1.85
37x4 1/2.....	9.50	1.90
35x5.....	8.50	2.00
36x5.....	9.50	2.00
37x5.....	9.75	2.20

All goods shipped C. O. D. subject
to examination on receipt of 10%
of order.

All shipments made promptly. To
avoid delay, kindly mention style of
your rim when ordering tires, as
we have them in straight side,
clincher and Q. D. clincher.

Tire Repair & Supply Co.

1463 Michigan Ave. Chicago, Ill.

A GREAT TIRE AND TUBE SALE

100 makes, 15,000 tubes and shoes. New and All
stock. At ridiculously low prices. Saving from
40% to 70%. Cheapest house in the city.

JANDORF AUTOMOBILE CO.
1764 Broadway New York City

A CHANCE TO BUY NEW HIGH GRADE STANDARD MAKE TIRES at WHOLESALE PRICES Satisfaction Guaranteed

Size	Plain	Non-Skid	Tubes
28x3	\$ 6.00	\$ 6.50	\$1.50
30x3	6.50	7.50	2.00
30x3 1/2	8.50	9.50	2.20
31x3 1/2	8.90	9.35	2.00
32x3 1/2	9.80	10.25	2.05
34x3 1/2	10.20	11.25	2.10
36x3 1/2	10.60	13.20	2.15
30x4	11.50	12.20	2.25
31x4	11.90	13.80	2.30
32x4	12.95	14.10	2.35
33x4	13.95	14.05	2.55
34x4	15.00	16.20	2.70
35x4	15.20	16.80	2.75
36x4	15.40	17.00	2.80
37x4	15.60	17.10	2.85
34x4 1/2	17.50	19.25	3.25
35x4 1/2	17.95	19.60	3.60
36x4 1/2	18.50	19.95	3.60
37x4 1/2	18.95	20.75	3.65
38x5	19.95	21.95	4.95
36x5	21.00	22.50	4.00
37x5	22.50	23.75	4.10

10% Deposit Required with Order. Shipped C.O.D. Subject to Your Examination

The Chicago Tire & Supply Co.
2129 Michigan Ave. Chicago, Ill.

ALL GUARANTEED TIRES all STANDARD MAKES

Size	Smooth	Non-Skid	Size	Smooth	Non-Skid
28x3	\$ 6.35	\$ 7.15	35x4	\$15.35	\$16.00
30x3	7.25	7.85	36x4	16.25	16.85
32x3	7.85	8.25	37x4	16.50	16.95
32x3 1/2	8.95	9.45	38x4 1/2	17.85	18.25
30x3 1/2	9.85	10.45	34x4 1/2	18.45	19.85
31x3 1/2	9.95	10.55	35x4 1/2	19.50	20.85
32x3 1/2	10.55	11.60	36x4 1/2	20.40	21.50
33x3 1/2	10.85	11.70	37x4 1/2	21.60	22.85
34x3 1/2	10.95	11.85	38x5	21.75	22.95
30x4	12.65	12.80	35x5	21.85	23.25
31x4	13.45	13.85	36x5	22.60	23.50
32x4	13.85	14.85	37x5	23.85	24.50
33x4	14.65	15.85	37x5 1/2	24.75	25.00
34x4	15.25	15.95	38x5 1/2	25.50	26.00

We guarantee all tires sold by us at the above prices to be free from imperfections in material and workmanship.

We are the World's largest exclusive Tire Dealers, with immense purchasing power. We go direct to the factory and buy job lots and overstocks. We pay spot cash for all tires and sell for cash only. We sell direct to the consumer.

HOW TO ORDER—Send \$1 deposit for each tire ordered. Tires will be sent C. O. D., with privilege of examination. Specify style of rim, plain or non-skid.

Tire Company of America

1927-31 Grand Ave. Kansas City, Mo.

AUTO TIRE BARGAINS
Biggest advertised 4,000 and 5,000 mile Standard Tires—new, fresh, clean stock. Some slightly blemished.

Size	Plain	Non-Skid	Size	Plain	Non-Skid
28x3	\$ 7.00	\$ 7.50	34x4	\$14.00	\$15.00
30x3	8.50	9.50	36x4	16.00	17.00
30x3 1/2	8.50	9.50	35x4 1/2	18.00	19.00
32x3 1/2	10.00	11.00	36x4 1/2	18.00	19.00
33x4	14.00	15.00	37x5	18.00	19.00

All sizes at bargain prices. Send \$1 deposit for each tire ordered. We send balance C. O. D. Mooney Tire Co., 4547 Delmar, St. Louis, Mo.

A GREAT SAVING ON 4000 MILES GUARANTEED TIRES AND TUBES

Our tires are guaranteed to give service up to 4000 miles under fair usage and claims for insufficient mileage will be adjusted on a mileage basis when casings are returned by prepaid express.

Our casings are not guaranteed against bottle cuts, rock cuts, or being run flat. Prices will soon be forced to rise.

ORDER NOW

New Guaranteed Firsts Tires and Tubes at

SACRIFICE PRICES For a Short Time Only

Tires	Tubes	Tires	Tubes
28x3.....\$ 4.95	\$1.55	34x4.....\$12.60	\$3.15
30x3..... 6.50	1.90	36x4..... 13.30	3.10
30x3 1/2..... 8.00	2.10	37x4..... 13.75	3.20
31x3 1/2..... 8.05	2.20	34x4 1/2..... 15.45	3.40
32x3 1/2..... 8.55	1.95	35x4 1/2..... 16.35	3.80
34x3 1/2..... 9.05	2.10	36x4 1/2..... 16.15	3.90
36x3 1/2..... 10.20	2.35	37x4 1/2..... 16.65	4.20
32x4..... 10.85	2.90	36x5..... 17.55	4.55
33x4..... 12.10	2.95	37x5..... 18.90	4.65
35x4..... 12.85	3.10	37x5 1/2..... 28.50	5.10

Add 10% for Non-Skid

Our used tires listed below guaranteed 1500 miles and adjustable on that basis in accordance with the above guarantee. This gives you an opportunity to equip your car with used tires and be protected.

Tires	Tubes	Tires	Tubes
30x3.....\$3.50	\$1.20	36x4.....\$7.35	\$1.85
30x3 1/2..... 4.25	1.80	32x4 1/2..... 6.65	1.60
32x3 1/2..... 4.95	1.40	34x4 1/2..... 7.60	1.65
30x4..... 4.75	1.40	35x4 1/2..... 7.65	1.60
31x4..... 6.15	1.60	36x4 1/2..... 7.95	1.70
32x4..... 6.65	1.65	37x4 1/2..... 9.05	1.90
33x4..... 6.90	1.55	35x5..... 8.10	1.90
34x4..... 7.35	1.60	36x5..... 9.05	1.95
35x4..... 7.15	1.70	37x5..... 9.25	2.10

Add 10% for Non-Skid

These prices for new and used tires tell the story.

—NO SALESMANSHIP NECESSARY—

One dollar or deposit sufficient to defray express charges required with each order. Shipments made promptly C.O.D., subject to your inspection.

AUTO SALES & PARTS CO.

1602 S. Michigan Ave. Chicago, Ill.

BEFORE BUYING

See our special price list on NEW STANDARD GUARANTEED TIRES AND TUBES

3500 miles written guarantee with every purchase. Our specialty is brand new tires and tubes. A postal will bring you full particulars and save you money.

McDANIEL RUBBER CO.

613 Ohio St. Cairo, Ill.

Biggest Tire Bargains

Standard 5,000-Mile Tires—Not Seconds

30x3 Non-Skid \$7.50

These tires were bought in a job lot, and are A BARGAIN

Also a Big Bunch of Used Tires

Will run from 2,000 to 4,000 Miles

Practically All Sizes, from 30x3 to 39x5

Prices from \$5 to \$15

Many of these tires are almost new. We tear down cars for parts and have always many used tires that are big bargains.

MAXWELL BROS. AUTO SALVAGE CO.

3933-35 Olive St. St. Louis, Mo.

BEAR TIRES

GUARANTEED FOR 5,000 MILES
At 1/4 Regular Price

BEAR TIRE COMPANY

1311 Michigan Ave. Chicago, Ill.

A GUARANTEE OF 4000 MILES

Adjustable on that basis in accordance with guarantee as offered by leading tire companies.

WITH EVERY TIRE LISTED BELOW

These tires are Double Tread Tires, method of construction of which is brought down to such perfection that it absolutely

Safeguards Your Inner Tube,

as well as gives you far more mileage than new ones.

This is no idle boast; a trial will convince you. High tire cost shot to pieces.

28x3.....\$ 4.75	35x4.....\$ 9.85
30x3..... 5.25	36x4..... 10.50
30x3 1/2..... 6.50	34x4 1/2..... 10.95
31x3 1/2..... 6.80	35x4 1/2..... 11.20
32x3 1/2..... 7.35	36x4 1/2..... 11.75
34x3 1/2..... 8.00	37x4 1/2..... 12.20
31x4..... 8.25	35x5..... 12.65
32x4..... 8.75	36x5..... 13.00
33x4..... 9.20	37x5..... 13.45
34x4..... 9.50	38x4 1/2..... 14.60

No punctures, blow-outs; no annoyance nor inconvenience when your car is equipped with above tires.

One Dollar or deposit sufficient to defray express charges required with each order. Shipments sent promptly C. O. D., subject to your inspection.

Empire Double Tread Tire Co.

1622 So. Wabash Avenue
Chicago, Ill.

CYCLONE TIRES

Are in a class by themselves. 2,500 miles guaranteed. Have records of 10,000 miles. Your old tires taken in exchange.

28x3.....\$5.00	34x4.....\$ 9.65
30x3..... 6.00	36x4..... 10.55
30x3 1/2..... 7.00	34x4 1/2..... 11.55
32x3 1/2..... 7.60	36x4 1/2..... 12.25

OTHER SIZES AT PROPORTIONATE PRICES IOWA SALES & MFG. CO.

813 Mulberry St. Des Moines, Ia.

Champion Double-Tread Tires

Just send us two old, wornout tires and we'll return a new tire, 90% puncture and blow-out proof, and guaranteed for 2,000 miles. Write today for our big, free money-saving price list. Address the

Champion Double-Tread Tire Co.

1710-18 Grand Ave. Kansas City, Missouri

Double Service Tires.—Guaranteed 3500 Miles

Size	Plain	Tubes	Size	Plain	Tubes
30x3.....	\$5.00	\$2.05	36x4.....	\$ 9.00	\$3.00
30x3½....	6.00	2.40	36x4½....	10.00	4.60
33x4.....	8.00	3.45	36x5.....	11.00	5.45
34x4.....	9.00	3.60	37x5.....	11.00	5.55

Non-Skid Tires, all sizes, \$1.00 Extra. State if C. D., Straight Bead or Clincher Type. 10% Deposit required on all C. O. D. orders. Discount of 5% when cash accompanies order. I. JAFFESS 1319 C Fifth Ave., New York. Branch 232c Halsey St., Newark, N. J.

WHAT HAVE YOU TO SELL?

If you have a used car, or parts and accessories of any kind and are looking for a buyer, an ad in the Clearing House Columns of MOTOR AGE will sell it.

For further particulars address
MOTOR AGE CHICAGO

GET the BENEFIT of OUR QUANTITY PURCHASES

We buy our tires in carload lots and actually save you from 35% to 50% on standard makes of tires.

Size	Plain	Non-Skid	Size	Plain	Non-Skid
30x3 1/2	\$ 8.10	\$ 8.20	36x4	\$11.25	\$11.75
32x3 1/2	7.85	8.75	37x4 1/2	16.85	17.25
34x3 1/2	7.90	8.25	34x4 1/2	16.85	17.50
30x4	7.50	7.75	35x4 1/2	16.95	17.85
32x4	10.50	11.75	36x4 1/2	16.50	16.75
33x4	11.75	11.95	37x5	18.75	18.85
34x4	13.85	14.35	35x5	17.90	19.00
35x4	9.85	10.50	36x5	18.50	18.75

10% deposit with order, balance C. O. D.

Manufacturers Auto Tire Co.
1450 Michigan Ave. Chicago, Ill.

NEW DOUBLE TREAD TIRES SENT TO YOU C. O. D.

No money in advance. Made from 2 of your old tires. Guaranteed for 100 days. We will furnish one or both tires if desired. Also buy, sell and exchange firsts, seconds, second-hand and double tread tires, and tubes.

World's largest exclusive tire dealers.

AUTO TIRE EXCHANGE

Write nearest branch for price list.

225 Halsey St. Newark, N. J.
237 E. Jefferson Ave. Detroit, Mich.
58-60 Temperance St. Toronto, Can.
1217 Harmon Pl. Minneapolis, Minn.

REAL RUBBER TIRES

ALL NEW TIRES—NOT REBUILT OR USED
There are tires and tires, but the tires we sell are of Standard Material, construction, and weight, and we are willing to prove it by sending all orders C.O.D. ON APPROVAL.

NO MONEY IN ADVANCE

Size	Plain	Non-Skid	Tube
30x3	\$ 6.00	\$ 6.65	\$1.85
30x3 1/2	7.90	8.70	2.10
32x3 1/2	8.60	9.50	2.30
34x3 1/2	9.10	10.05	2.40
32x4	12.00	12.95	3.00
33x4	12.35	13.35	3.10
34x4	12.60	13.60	3.15
36x4	13.50	14.60	3.35
35x4 1/2	17.50	18.90	3.95
36x4 1/2	17.85	19.30	4.00
37x4 1/2	18.60	20.10	4.15
37x5	20.75	22.50	4.75

Inner Tubes Fully Guaranteed

All Orders C. O. D. on Approval

NO MONEY IN ADVANCE

TIRE SUPPLY COMPANY

1208 Hennepin Ave. Minneapolis, Minn.
1706 Commerce Ave. Dallas, Texas
1611 Grand Ave. Kansas City, Mo.

NO ADVANCE IN OUR TIRE PRICES

Double Tread Tires

Guaranteed 3500 MILES

We save you 33 1/3 to 50%

Size	Plain	Non-Skid	Size	Plain	Non-Skid
30x3	\$4.90	\$5.90	33x4	\$7.85	\$8.85
30x3 1/2	5.75	6.75	34x4	8.75	9.75

Other sizes. 10% Dep. Required.

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Protect Your Inner Tubes

with

Hampton's Inner Liner

when you Double Tread your tires. This liner, made of two pieces of highest grade tire fabric with a layer of chrome leather vulcanized between, keeps the heavy stitching, used to Double Tread your tires, from cutting or puncturing your inner tube.

PREVENTS BLOW-OUTS

Write for our price list and pamphlet explaining the Right Principle.

HAMPTON-CAMPBELL CO.
501-503 No. Illinois Indianapolis, Ind.

OUR ONLY EXCUSE

for these low prices for

TIRES

is that we are overstocked on these few sizes and styles.

BUY NOW WHILE THEY LAST

Note: Every tire we sell is subject to return if unused, and complete refund if not up to customer's expectation.

Size	Type	Tread	Price Each
37x5	Straight Side	Smooth	\$18.57
36x5	Clincher Q D	Smooth	17.88
36x5	Clincher Q D	Non-Skid	18.80
36x5	Straight Side	Non-Skid	18.80
35x5	Clincher Q D	Smooth	17.65
35x5	Clincher Q D	Non-Skid	18.63
36x4 1/2	Straight Side	Smooth	15.70
36x4 1/2	Clincher Q D	Smooth	15.70
30x4	Clincher Q D	Smooth	7.00
32x3 1/2	Clincher Q D	Smooth	5.87

Above are seconds of good quality. Many of them have the factory name. All are of very recent manufacture.

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TERMS CASH OR C. O. D., F. O. B. INDIANAPOLIS.

SEND 25% OF ORDER TO INSURE CARRYING CHARGES.

Guarantee Tire & Rubber Company

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Compare prices, Guarantees, etc., of the tires you are using with 70 leading Standard Make Guaranteed Tires. Nothing like it published. Non-Skid list, L.A., 10c. TIRE LIST CO., P. O. Box 1518, Pittsburgh, Pa.

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Let us quote you our prices on TIRES and TUBES of every

Well Known Make

When writing us please mention size, type and name of tire desired and we will send you

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TIRES AT 1/4 PRICE

Will Run 5,000 Miles and More

These tires are of double thickness and have 12 plies of fabric; therefore no punctures, no blow outs. They are rebuilt by our special process, vulcanized and double treaded.

30x3.....\$4.50 32x3 1/2.....\$5.75 34x4.....\$7.75
30x3 1/2.....5.50 35x4.....7.50 36x4.....9.00
Send \$1 deposit for each tire ordered, and we will send the tire, balance C. O. D.

CHICAGO D. T. CO., Mfrs.

1233-37 Wabash Ave. Chicago

TIRES

I Establish Cut-Rate Tire Agencies

There should be one in every locality—High cost of tires worries the auto owner.

One of the Best Paying Lines of Business

Nice Clean Stock No Credit
No risk. Should net at least \$400 monthly from now on and steadily increase. You can undersell your competitor 50 per cent and still give splendid value. Experience unnecessary. About \$500 cash required. Investment well secured. No traveling or canvassing, but a business of extraordinary merit suitable for any industrious man who means business.

This is an exclusive proposition and I give exclusive territory to right parties

TIRES COST YOU

In one or more makes

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30x3 1/2 Non-Skid.....6.80

Other Sizes in Accordance

Immense Stock—Prompt Shipments

If you are tied up in the General Garage or Automobile Agency business—not necessary to reply. But, if you are free to enter in a money-making business and devote your entire time to it, answer immediately.

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We absolutely guarantee all work done by the OXWELD PROCESS of welding and cutting, including welding cracked or defective cylinders, crankshafts, housings, aluminum crank and transmission cases, etc., etc. Estimates furnished on job and contract welding and cutting of all kinds.

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FINISHED WELDING

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If you have a used car, or parts and accessories of any kind, and are looking for a buyer, an ad in the Clearing House columns of Motor Age will sell it.

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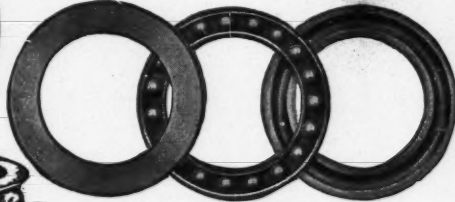
Mallers Building

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The Bearings Company of America
LANCASTER, PA.

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Western Office
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Detroit, Mich.



COMPLETE THRUST BEARING



RADIAL RETAINERS



Manufacturers of Star Radial Ball Retainers, Star Ball Thrust Retainers, Star Complete Ball Thrust Bearings

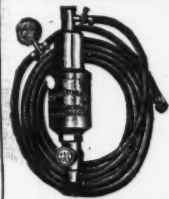
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Jackson, Michigan

Every Car Owner in your territory is a Jackson Trailer prospect. Full light truck service at smallest cost. This means many sales—quick business—fine profit.

Capacity for all haulage up to 1/2 ton. Write for liberal proposition. Best-known, fastest-selling trailer. Address Dept. B.

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Why bother with gears, brackets and etc., when a Brown Pump can be attached to your motor in an instant and always ready for use. Outfit is complete with Q. D. Plug, hose, gauge and etc. Price \$12.00.

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Guaranteed

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Manufacturers of Springs
For All Cars All Models
Write for replacement list
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Its Construction, Operation and Repair

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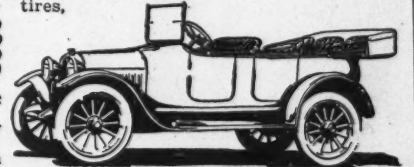
Every Inter-State has proved its value definitely and conclusively in the hands of owners.

If you want to know about proved value and actual assets for either the man who buys or sells cars, write today.

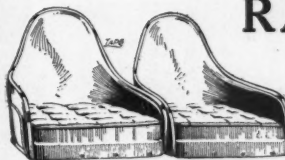
Powerful, high speed, long stroke valve-in-head motor. Beautiful streamline body, seating five passengers comfortably. Two unit Remy electric Starting. Lighting and Ignition. Oversize tires.

Inter-State
Motor Company
Muncie Indiana

both front and rear. Aluminum running boards. Heavily braced crown fenders. The most accessible medium priced car on the market.



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Imitation Leather upholstered, very classy seats, pair....\$13.50

Only a limited supply

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1827 McGee St., Kansas City, Mo.



Dash Light, Trouble Light, Search Light, Reading Light, Flash Light, Utility Light, and Delivery Light — All in One

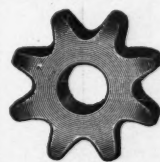
Instantaneous light when you want it; where you want it, by taking lamp to any part of the car; when through using it the automatic rewind takes up cord instantly and draws lamp into place as a dash light. Attach it to car yourself; cord case and mechanism concealed under hood. Only \$5. Pin \$5 bill to your letter, send today. COMET CO., 39 N. Cherry St., Galesburg, Ill. Agents wanted; exclusive territory.



Don't Discard Worn Bearings
We Regrind Them Good as New at
About 1/5th List Price of New Bearings

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Branches: Los Angeles, 325 W. Pico St.; New York, 1790 Broadway; Boston, 93 Massachusetts Ave.; Cleveland, 1841 Euclid Ave.; Detroit, 790 Woodward Ave.; St. Louis, 2831 Locust St.; Minneapolis, 926 Marquette Ave.



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CHAINS AND DIFFERENTIAL

IN STOCK OR ORDER
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The Dutch Girl Says:



"DUTCH BRAND Products constitute ideal first aid to injured motor cars."

Your dealer will supply you

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The Rubber Cement Authorities
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Guaranteed for 10,000 Miles



BRICTSON Pneumatic Tires are guaranteed for 10,000 miles and under a specific 10,000-mile written service guarantee. What more could you ask of a tire? With Bricton Tires, punctures, blow-outs and rim-cuts are eliminated—they are proof against ruts, oil and gasoline. Resilient and easy riding, too.

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Give Bricton Tires a free trial on your own car. Put them to test at our expense. Find out why Bricton Tire sales are increasing daily.

Your Tires Rebuilt the Bricton Way

If the fabric in the tires now on your car is in good condition, we can take them and make them proof against rim cutting, punctures, blow-outs, sidewall breaks, skidding, ruts and oil and give you thousands of miles of additional service.

Write today for full information about Bricton Tires. Tire Rebuilding and details of our liberal Free Trial Offer.

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One of the Principal Reasons
**ELECTRIC
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Give Little Bother Nowadays
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109 MAKERS

are using the

ECLIPSE-BENDIX DRIVE

Eclipse Machine Company
ELMIRA, N. Y.

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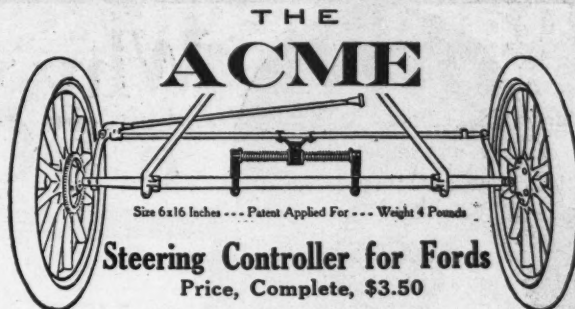
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The ACME STEERING CONTROLLER is a simple and substantial Accessory, of practical value to all Ford Car Owners.

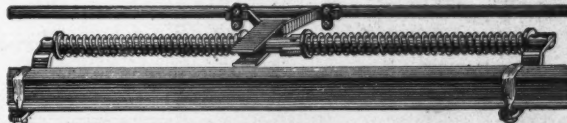
By the pressure of two coil springs acting upon the tie rod, the car automatically tends to a straight course, regardless of holes and obstructions, thereby relieving the strain of driving.

The ACME STEERING CONTROLLER is the only practical steering device for Ford Cars on the market. As proof of this, not 1% of those sold to date have been returned. However, the Manufacturers stand ready to take back and make refund to the dealer for any machine returned.

It is easily seen from the description what the device will do, and the Ford Car Owner readily buys because of its simplicity and apparent effectiveness.

Have the device in stock and be in line for sales. Be the first dealer to introduce the ACME STEERING DEVICE in your territory, and gain this advertising advantage.

Write to your jobber or to us for the discount to dealers.



Acme Steering Device Co., Mfrs. 500 Windsor Bldg. Philadelphia, Pa.

FREE ROAD MAPS

Check maps
desired and
mail to

Gulf Refining Co.
Dept. 1875, Frick Annex
PITTSBURGH, PA.



MAIL THIS COUPON TODAY

Gulf Refining Co., 1852 Frick Annex, Pittsburgh, Pa. — Gentlemen: Please mail me FREE as per your special offer the maps as I have checked:

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<input type="checkbox"/> Transcontinental	<input type="checkbox"/> Southern States
<input type="checkbox"/> New England	<input type="checkbox"/> Pennsylvania
<input type="checkbox"/> New Jersey	<input type="checkbox"/> Texas
<input type="checkbox"/> Pittsburg to Philadelphia	<input type="checkbox"/> Allegheny County

Name.....
 City..... State.....

Why we can afford to give a 5000-Mile Guaranty

WE'LL tell you candidly it would be a business impossibility for us to guarantee a mileage that our tires wouldn't cover **consistently**. Claims and adjustments would put such a crimp in our profits that business simply couldn't pay. And we're out to do a **permanent** business, on a fair and square basis.

We therefore were compelled to guarantee a **minimum** mileage: A mileage which the most exhaustive road tests have proved, beyond question of doubt, that Delion Tires can be depended upon to give **almost unfailingly**.

The Delion 5000-Mile Guaranty means that Delion Tires **CONSISTENTLY** give **MUCH OVER 5000 miles**.

DELION PNEUMATIC TIRES

It is one thing to make a freak mileage "record" now and then. But quite another to give **consistently** extra-mileage—as do Delion Tires.

"Cooking" counts most in giving durability to tires. The "cooking" of Delion Tires is supervised personally by John E. Thropp Sons Company—known throughout the country for many years as leading experts and builders of tire-making machinery.

The resulting long life, "accident-proofing"—the greatest possible freedom from tire troubles, and continued resiliency of Delion Tires, we believe constitute a distinct advance in tire-making.

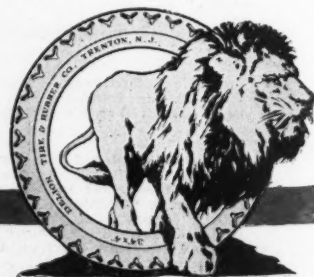
As for other recommendations—the Delion **PERMANENT Non-Skid** feature alone is a sales argument to win and hold customers. The Delion **INDENTED Tread** keeps a sure, safe grip on the road until the tire is worn out.

And, with the tread's smooth riding surface, you get all the **RIDING-COMFORT** a smooth-tread tire gives.

DEALERS should be interested in this, too: We back our promises to every dealer with a binding **SALES CONTRACT**. This establishes him as the **one and only distributor** of Delion Tires in his **clearly defined territory**, with full control of his territory, trade, price and profits.

It means his **certainty of right profit** and a **dependable increase** in annual business.

Write
for full
particulars



DELION TIRE & RUBBER CO.
INCORPORATED
1791 BROADWAY - NEW YORK CITY



HOUK

QUICK-CHANGE

WIRE WHEELS

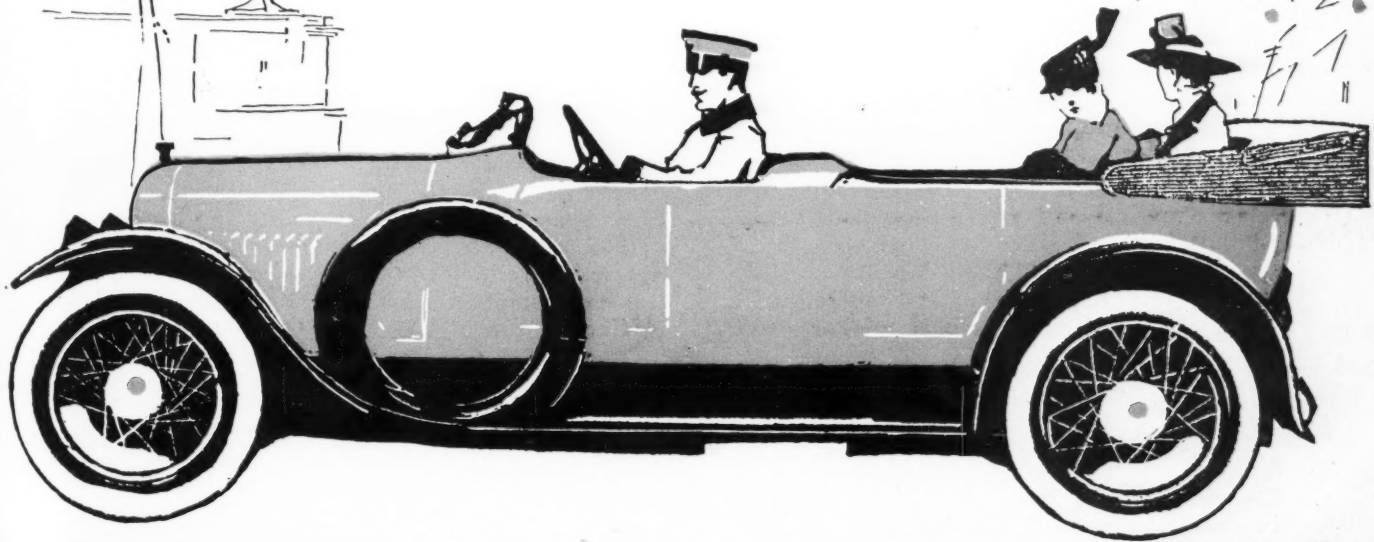
are essential to a perfectly appointed car.

They add a touch of refinement which cannot be obtained without them. And the reason is two-fold—a refinement of design to which is added a mechanical improvement that makes a car better in appearance and altogether more serviceable and comfortable.

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Detroit, 786 Woodward Ave.



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Where the family purse cannot afford a big expensive car—

Where the family pride cannot afford an unsightly, little, uncomfortable car—

There the \$615 Overland supplies a definite need with definite finality.

Here is the small, comfortable car—a beauty—complete to the last detail—inexpensive—economical—another and greater Overland success.

And its price—\$615—is far below any former price for any completely equipped automobile—regardless of appearance or comfort considerations.

As you look the car over and read its specifications, you realize its absolute completeness.

But you must ride in it to appreciate its comfort.

You must drive it to get the thrill its performance will give you.

You can own one of these cars.

But act promptly for naturally no car was ever in such demand.

No other car at anywhere near its price can compare with this one for beauty, performance, comfort, completeness and economy.

Get in touch with the Overland dealer today—now.

The Willys-Overland Company, Toledo, Ohio

"Made in U. S. A."



